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# Simulated Patient Situations in a Continuing Education Course for Practical Nurses

Faith Mahleah Jones  
*Loyola University Chicago*

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SIMULATED PATIENT SITUATIONS IN A  
CONTINUING EDUCATION COURSE FOR  
PRACTICAL NURSES

by

Faith M. Jones

A Dissertation Submitted to the Faculty of the School of Education  
of Loyola University of Chicago in Partial Fulfillment  
of the Requirements for the Degree of  
Doctor of Education

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## LIFE

The author, Faith Mahleah Jones, is the daughter of Philip and Mair Eluned (Thomas) Jones. She was born January 26th, 1935 in Yunnan, Southwest China where she lived for four years.

Her elementary and secondary education was obtained in Cardiff, South Wales, Great Britain, the country of her parent's birth.

In 1953, the author came to the United States with her mother and sister where she travelled for two years in church work.

In September, 1955, she entered Wheaton College, Wheaton, Illinois. In September, 1959, she received her license as a Registered Nurse and in June, 1960 received the degree of Bachelor of Science with a major in professional nursing.

The author returned to Great Britain to study midwifery and received a State Certificate to practice midwifery in 1963.

Returning to the United States, the author worked at Cook County Hospital School of Nursing and the Chicago Board of Education, teaching Practical Nursing.

While working, she entered Roosevelt University, Chicago, where in June 1971, she was awarded the Master of

## Arts in Education.

Throughout her professional life, the author has been a member of the American Nursing Association and is now also a member of the Illinois League for Nursing.

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## CHAPTER I

### THE NATURE OF THE PROBLEM

#### Introduction

This study attempted to compare the effectiveness and efficiency of two teaching methods: (1) simulated patient situations and (2) traditional teaching methods.

Simulated patient situations meant a series of life-like presentations which introduced the subject matter either orally, as in role-playing, or in a written, pencil and paper format.<sup>1</sup> The situations were presented as if the subject encountered a real-life experience. The subject participating in the situation had to recognize the given problem and seek further information in order to resolve the difficulty. Every subject made his own decisions as to the appropriate actions to be taken. On the basis of these actions further experiences were presented as if in a real-life setting. If the wrong choice was made a new situation arose. As simulated patient situations gave immediate feedback the subject knew the effect that his action had on the patient involved in the presentation.

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<sup>1</sup>Christine H. McGuire, Lawrence M. Solomon and Philip G. Bashook, Construction and Use of Written Simulations (New York: Psychological Corporation, 1976), pp. 1-24.

The traditional method of teaching was an expository, lecture method in which the subject was expected to listen as the teacher discussed or explained the subject matter.<sup>2</sup>

Effectiveness was to be measured in terms of the student's achievement in learning cognitive skills according to Handbook I of the Taxonomy of Educational Objectives.<sup>3</sup> Efficiency was to be measured in terms of the time spent by the students during the learning period.

#### Statement of the Problem

Ninety-six practical nursing students were studied to see if there was a difference in the problem-solving ability scores on a posttest. Differences were examined between practical nurses who received simulated patient situations with immediate feedback and with practical nurses who were taught by the traditional method and received delayed feedback. Problem-solving referred to the way in which the practical nurse dealt with a problem.

The research problem was to be formulated in terms of two questions and a number of related subproblems.

1. Would higher cognitive competencies be achieved by practical nurses enrolled in a Pharmacology and Medication

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<sup>2</sup>Hilda Taba, Curriculum Development: Theory and Practice (New York: Harcourt, Brace and World, 1962), pp-59-64.

<sup>3</sup>Benjamin S. Bloom et al., Taxonomy of Educational Objectives: Handbook I: Cognitive Domain (New York: McKay, 1956), pp. 62-161.

Administration Program which incorporated simulated patient situations than a comparison group of practical nurses enrolled in a traditionally taught program?

2. How did practical nursing problem-solving abilities differ on the basis of age, prior nursing experience and length of study time?

### Subproblems and Hypotheses

Subproblem 1: To determine the effectiveness of simulated patient situations and traditional methods of teaching for helping practical nursing students solve problems.

Hypothesis 1: There will be no difference in the problem-solving scores on a posttest for practical nurses who receive simulated patient situations and for practical nurses who receive traditional methods of teaching.

Subproblem 2: To determine the efficiency of simulated patient situations and traditional methods of teaching for helping practical nursing students solve problems.

Hypothesis 2: There will be no difference in problem-solving ability scores for practical nurses who receive simulated patient situations and practical nurses who receive traditional methods of teaching by the amount of time spent in studying.

Subproblem 3: To determine the various relationships between problemsolving ability scores for practical nurses who receive traditional methods according to years of previous nursing experience.

Subproblem 4: To determine if the development of lower as well as higher mental processes are achieved by the use of simulated patient situations and by the use of traditional methods of teaching.

Hypothesis 4: There will be no difference in the development of lower as well as higher mental processes for practical nurses who receive simulated patient situations and for practical nurses who receive traditional methods of teaching.

#### Rationale

In providing written simulated patient situations to practical nurses the opportunity was given to develop skills of problem-solving. The nurse was given the choice of an appropriate nursing action without endangering the lives of real patients. Berner and Nerenberg considered that as the simulation provided immediate knowledge of results, the nurse learned from the consequences of the action.<sup>4</sup>

Practical nurses who would be giving medications to patients in the future needed to learn how to make decisions before confronting problems during their course of work. The simulated patient situation was a teaching strategy designed

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<sup>4</sup>Eta S. Berner and Rene L. Nerenberg, "The Construction of Written Simulation Problems," lecture notes, University of Illinois at the Medical Center, Chicago, Fall semester, 1975.

to assist the practical nurse to develop skills of problem-solving.

### Definition of Terms

Simulated Patient Situations: A realistic portrayal of a patient with an unidentified problem which was presented either orally, as in role-playing, or in a written, pencil and paper format. The situation required decisions to be made and acted upon. In the pencil and paper exercises, each section was constructed so that different decisions might be made according to the judgement of the student.<sup>5</sup>

Problem Solving Ability: A skill in which a problem was first defined, a solution selected from several alternatives, and an action performed to resolve the problem.<sup>6</sup>

Feedback: The knowledge of results following a performance of a task.<sup>7</sup>

Traditional Method of Teaching: An expository method of teaching in which the teacher usually lectured and asked questions. Students responded by listening, answering

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<sup>5</sup>Christine H. McGuire and David Babbott, "Simulation Techniques in the Measurement of Problem-Solving Skills," Journal of Educational Measurement 4 (Spring, 1976): 1-10.

<sup>6</sup>Christine H. McGuire and Lawrence M. Solomon, Clinical Simulations: Selected Problems in Patient Management (New York: Appleton-Century Crofts, 1971), p. 1.

<sup>7</sup>Julia Quiring, "The Autotutorial Approach," Nursing Research 21 (August, 1972), 332-37.

questions and asking other questions concerning the material presented.<sup>8</sup>

Licensed Practical Nurse: A graduate of an accredited practical nursing program who had passed a state board licensing examination and therefore was qualified to practice nursing in that state.<sup>9</sup>

Pharmacology: A branch of medicine that dealt with the use of drugs in the treatment, prevention and diagnosis of diseases.<sup>10</sup>

Medication Administration: The act of giving medications which the physician had prescribed in an efficient and safe manner.<sup>11</sup>

Symptoms: The reactions of specific medications, disease or disorders which may be experienced by the patient.<sup>12</sup>

Nursing Action: A specific act which was designed to help the patient. This act was observable and required a series of interdependent decisions, using both judgement

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<sup>8</sup>Taba, pp. 387-88.

<sup>9</sup>Springfield, Illinois, Department of Registration and Education, Rules and Regulations Promulgated for the Administration of the Illinois Nursing Act (1975), sec. VIII, p. 24.

<sup>10</sup>Morton J. Rodman and Dorothy W. Smith, Clinical Pharmacology in Nursing (Philadelphia: Lippincott, 1974), p. 3-4.

<sup>11</sup>Ibid., p. 5.

<sup>12</sup>Laura E. Govoni and Janice E. Hayes, Drugs and Nursing Implications 2d ed. (New York: Appleton-Century-Crofts, 1965), p. 5.

and skill.<sup>13</sup>

Nursing Experience: The number of years a practical nurse has worked in hospitals and/or other health-care institutions.<sup>14</sup>

Aseptic Technique: The prevention of bacteria from contaminating the equipment or the patient site.<sup>15</sup>

Physician's Orders: A written record of prescribed medications written by a licensed physician.<sup>16</sup>

Kardex: A separate folder in which the physician's orders were transcribed to facilitate preparation and administration of medications.<sup>17</sup>

Medication Card: A card listing the patient's name and room number, the medication with its dosage, time of administration and the manner in which it was given, and the signature of the nurse preparing the card. This card was to be used to identify the appropriate medication as well as the correct patient.<sup>18</sup>

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<sup>13</sup>Faye G. Abdellah et al., Patient Centered Approaches to Nursing (New York: Macmillan, 1961), p. 36.

<sup>14</sup>U. S. Department of Labor, Restructuring Paramedical Occupations: A Case Study, by Harold M. Goldstein and Morris A. Horowitz, Report Nos. I & II (Washington, D.C.: Government Printing Office, 1972), p. 42.

<sup>15</sup>Margaret E. Dunn, "Development of an Instrument to Measure Nursing Performance," Nursing Research 19 (December, 1970): 502-10.

<sup>16</sup>Eric W. Martin, Hazards of Medicine (Philadelphia: Lippincott, 1971), P. 16.

<sup>17</sup>See Examples in Appendix A.

<sup>18</sup>Ibid.



## Pharmacology and Medication Administration Program: A

continuing education program for practical nurses who were required to prepare and administer medications in the hospitals in which they worked. The theory of pharmacology and nursing were taught to participating practical nurses by both registered pharmacists and nurses.

### Limitations

This investigation was limited by certain factors which were a threat to both internal and external validity. These were:

1. Only one Pharmacology and Medication Administration Program was analyzed. This Program was in the City of Chicago.
2. The sample was composed of ninety-six practical nurses who were working only in specific hospitals which required a certificate of achievement. Practical nurses who were not required to achieve such a certificate were not studied as to their pharmacological knowledge, nursing actions or their problem-solving ability.
3. Individual practical nurses were not randomized in order to receive the treatment of simulated patient situations. Lack of randomization threatened internal validity because each participant would not have the opportunity to be in the experimental or control group by chance. They were assigned to one of two intact groups according to available

space in the classroom. The two locations were in the same geographical area.

4. The covariates of pretest scores, age, study time and years of previous nursing experience were used to remove differences between the experimental group and the control group. It was impractical to obtain measurements of intelligence quotients or motivation from the sample of practical nurses involved in the investigation.

5. Teacher differences were not controlled. Therefore, all groups received lectures from different nurses and pharmacists. Each lecture was presented by a different person. A specific outline was followed and the lecture was given within a designated period of time for both groups. Each guest instructor was not told that the practical nurses were undergoing a study in problem-solving ability. The investigator was the only person who knew which group received the simulated patient situations.

### Significance of the Study

Simulated patient situations have been used to teach different types of students in medicine, dentistry and nursing. The simulations appeared as real-life situations in which the student acted as if working in a clinical unit.

This teaching method permitted immediate knowledge of the action taken so that the student retraced steps to determine if such an action was correct. Each simulated situation helped the student to make a decision concerning the care

of the patient.

According to the Rules and Regulations Promulgated for the Administration of the Illinois Nursing Act, the licensed practical nurse should administer new functions only after adequate instruction and practice.<sup>19</sup> Simulated patient situations were an attempt to give the practical nurse the opportunity to solve problems before working with the patient in the newly expanded role of medication nurse. In resolving such problems, the practical nurse may have learned appropriate skills and judgments of patient care.

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<sup>19</sup>Department of Registration and Education, p. 24.

## CHAPTER II

### REVIEW OF RELATED RESEARCH AND LITERATURE

#### Responsibilities and Functions of the Medication Nurse

Teaching pharmacology and medication administration to nurses was a difficult task because of the various aspects of knowledge, psychomotor skills and judgments involved. Also, there were numerous facets of nursing behaviors depending on the type of medication prescribed.

As the need for skilled medication nurses had grown, hospital administrators did not have enough professional nurses to meet the demands of increasing numbers of hospitalized patients. Therefore, many of them had to utilize the practical nurse to administer medications. Whether classified as professional or practical, medication nurses were responsible for knowing about the drugs they administered in order to give safe nursing care.<sup>1</sup> As the hospital administrator's prime concern should be for safe and therapeutic patient care, and as doctors rely on the nurse to relate adverse reactions of medications, it would seem appropriate that the medication nurse be as skillful as

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<sup>1</sup>Department of Labor, p. 9.

possible in the duties of medication administration.<sup>2</sup>

Society also expected certain reliable practices in medication administration. The Controlled Substance Act of 1971 established a system for control of specific dangerous drugs. Under the law, the medication nurse was to be under the direction of a physician who prescribed the medication, but the nurse was still responsible for her own acts in administering the drugs.<sup>3</sup> The field of pharmacology expected medication nurses to have competencies in seven areas of drugs administration. These expectations were:

1. Expected effect of a drug within the body
2. Average dose of a drug for an adult or a child
3. Routes of administration of a drug
4. Rate of drug excretion in a healthy adult
5. Known drug interactions or incompatibility of a drug
6. Symptoms of toxic effects and side effects of a drug
7. Idiosyncratic reactions to a drug<sup>4</sup>

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<sup>2</sup>Helen Creighton, Law Every Nurse Should Know, 3d ed. (Philadelphia: Saunders, 1975), p. 20.

<sup>3</sup>U. S. Department of Justice, Drug Enforcement Administration, Drug Enforcement, Special Issue, (Washington, D.C.: Government Printing Office, Spring, 1975), p. 6.

<sup>4</sup>Joyce K. Keithley, "Actual Drug Knowledge Correlated with the Importance of Drug Knowledge" (Master's thesis, DePaul University, 1971), p. 10.

Such basic knowledge should be the goal of every practicing medication nurse. This expectation demanded a thorough knowledge of chemistry and physiology, which most practical nurses lack. For this reason, hospital administrators have been reluctant to utilize practical nurses to administer medications except in times of crisis when the hospital was short of professional nurses.<sup>5</sup>

According to Goldstein and Horowitz licensed practical nurses have been either improperly utilized or under-utilized in most hospitals. With further training the practical nurse could become more efficient.<sup>6</sup> Similarly, Tomlinson states that the "insistence upon narrow and unrealistic definition of performance, contrary to observed and reported evidence by licensed practical nurses actually employed in the field, will contribute to inappropriate utilization of personnel."<sup>7</sup> Tomlinson's objective to improve health care was linked to restructuring occupations and to improving the utilization of manpower in hospitals and institutions.

In light of the present under-utilization of practical nurses it should be the goal of the schools of nursing to train practical nurses to function competently in the area of

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<sup>5</sup>Robert M. Tomlinson, Occupational Patterns and Functions of Employed Licensed Practical Nurses (Urbana, Illinois: University of Illinois Press, 1969), p. 52.

<sup>6</sup>Department of Labor, p. 9.

<sup>7</sup>Tomlinson, p. 40.

medication administration. Most nursing schools would agree that their job is to produce a practical nurse who is both knowledgeable and skillful. But the literature contains few examples of programs which employ a systematic problem-solving method to ensure that their graduates are capable of fulfilling the role of medication nurse as required in our present and future society.

If the basic practical nursing program did not teach medication administration, Tomlinson suggested a continuing education program established in the various hospitals utilizing practical nurses as medication nurses.<sup>8</sup> Many such programs have been established in individual hospitals. However, evaluation emphasis in many programs was usually concerned with psychomotor skills and basic knowledge. It appeared difficult to teach or to evaluate the higher level skills required to solve problems encountered in the preparation, administration and follow-up of medication administration. According to Peplau, the true function of the nurse was to identify problems and to use skills to intervene during crises so that the patient became well.<sup>9</sup>

By means of effective nursing care, practical nurses also may help their patients overcome the illness that

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<sup>8</sup>Ibid., p. 74.

<sup>9</sup>Hildegard Peplau, Interpersonal Relations in Nursing (New York: Putnam, 1952), p. 50.

accounts for their hospitalization. Tomlinson states that, although the functions of professional and practical nurses may overlap, "the real difference in the performance of these functions . . . is the degree of authority and responsibility each performer carries . . . . [which] should also be explicitly noted in the job description."<sup>10</sup>

According to the Rules and Regulations Promulgated for the Administration of the Illinois Nursing Act, the licensed practical nurse shall "participate in planning, implementing and evaluating nursing care by applying principles and initiating procedures to safeguard life and health."<sup>11</sup> The practical nurses needed to be guided toward skillful problem-solving ways of meeting patient's needs.

Problem-solving should be taught in the actual clinical setting. Most nursing programs offered practice in which medications were given to real patients. The fact that human patients were involved in nursing education prevented extensive use of trial-and-error learning. This trial-and-error method was a component of earlier nursing education. Currently, the application of physical and social sciences have enabled nurses to be more aware of the patient as a whole person and to plan total care accordingly. However, many schools of nursing still relied on the assignment of patients

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<sup>10</sup>Tomlinson, p. 76.

<sup>11</sup>Department of Registration and Education, p. 24.



to students with the hope that the patient will portray some symptom of difficulty so that the student will have practical experience.<sup>12</sup>

In a student nursing assignment, the disease entity was usually the reason for taking care of the patient. It was difficult to assign patients who would exhibit medication problems. If the symptoms occurred due to the incompatibility of drugs only a few students were able to see such complications. Since the life of the patient was at stake, duties of the nursing student were minimized. Other members of the health team were usually called upon to rectify an error or to revitalize a life. Therefore, there were few clinical situations in which the student nurse learned to use judgment to solve problems associated with the serious side effects of medication administration.

Yet, the practical nurse was expected to meet the total health requirements of patients. The accuracy of making a judgment correctly and taking action immediately would result in better patient care.

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<sup>12</sup>Donna C. Aguilers, "The Relationship of Performance in Selected Problem-Solving Tasks to Participation in a Crisis Intervention Course for a Sample of Nurses in a University Baccalaureate Program" (Ph.D. dissertation, University of Southern California, 1975), p. 8.

## Learning to Solve Problems in Health Care

Many aspects of problem-solving were involved in health care. Any member of the health team was required to make judgments as to the appropriate action to be taken in the care of patients. According to Levine and McGuire "the trait 'judgment' may be used in terms of 'problem-solving' or 'decision making'."<sup>13</sup>

At the University of Illinois Medical School's certifying examination, the trait "judgment" was described in terms of an effective candidate who:

Recognizes his own capabilities and used procedures which correspond to them. He considers simple procedures first. His clinical judgment encompasses information beyond the pathological. He demonstrates regard for patient's needs, desires and life conditions. He is flexible enough to modify his treatment plans when the situation warrants doing so.<sup>14</sup>

The judgments of the medical students were evaluated in three different ways. These evaluation methods were: (1) oral examinations, (2) multiple-choice examinations, and (3) simulation exercises. The raters evaluated the candidate's problem-solving ability by describing it as a component which:

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<sup>13</sup>Harold G. Levine and Christine H. McGuire, "The Validity and Reliability of Oral Examinations in Assessing Cognitive Skills in Medicine," Journal of Educational Measurement 7 (Summer, 1970):65.

<sup>14</sup>Ibid., p. 69.

deals with the candidate's ability to use the information he has to make appropriate decisions in patient diagnosis and treatment as displayed by the data he solicits about patients.<sup>15</sup>

The medication nurse also must learn to conceptualize events and symptoms and to make judgments about them. Nurses need skills to recognize both overt and covert problems and to resolve such problems.

McDonald and Harms found that problem-solving skills may be learned by applying specific techniques. These were to: "(1) define the problem, (2) choose different aspects for a solution, (3) weigh different probabilities of each solution, and (4) understand the principles behind each decision."<sup>16</sup> Such a process encouraged the student toward self-discovery. Nurses who utilize this method to learn problem-solving must seek out problems themselves and work through to different solutions. According to McDonald and Harms, the "inquiry method imposed by this model must be rigidly practiced through-out the student's total experience in order for her to become skillful in the examination of each solution."<sup>17</sup>

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<sup>15</sup> Ibid., p. 74.

<sup>16</sup> Frederick J. McDonald and Mary T. Harms, "A Theoretical Model for an Experimental Curriculum," Nursing Outlook 14 (August, 1966):48.

<sup>17</sup> Ibid., p. 49.

In a management seminar in problem-solving, Likert extended a similar model to include gathering data and arranging a plan of action.<sup>18</sup> According to Haley, problem-solving involved a tactic in which the subject attempted to make a logical structure of the problem. If the language was incomprehensible to the subject, the problem would be unresolved. If such a problem was solved without understanding the language the solution was by chance alone and not by problem-solving.<sup>19</sup> In order to teach problem-solving to practical nurses, the language used must be at the level which would be understood by the students. Specific educational goals need to be incorporated into the curriculum.

### Survey of Learning Theories

Educators, from the time of Pestalozzi and Froebel to the present, have been critical of traditional teaching methods in which the student listens to the exposition of the subject matter. Pestalozzi stated that "education must guide and stimulate self-activity."<sup>20</sup> Froebel adopted the

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<sup>18</sup> Rensis Likert, The Human Organization: Its Management and Values (New York: McGraw-Hill, 1967), p. 57.

<sup>19</sup> John V. Haley, "Effects of Training on the Test of Diagnostic Skills," Chicago: Loyola University of Chicago, 1963. (Mimeographed), p. 16.

<sup>20</sup> Paul Monroe, "Pestalozzi, Johann Heinrich," A Cyclopedia of Education, IV (New York: Macmillan, 1913), 655-59.

same principle and established his kindergarten upon the ideal.

Proponents of the activity principle received impetus from Dewey and the Progressive movement in education. Throughout his life, Dewey emphasized "learning by doing."<sup>21</sup> His theory represented five stages in the process of attaining the solution. These were: (1) difficulty was felt, (2) difficulty was located, (3) possible solutions were suggested, (4) consequences were considered, and (5) solution was accepted.<sup>22</sup> According to Dewey, experience was the means and the goal of education. Those experiences which lead to the learner's growth and further capacity for growth in a desirable way were considered to be a part of education.<sup>23</sup>

Guilford attempted to understand the nature of intellectual activity in problem-solving by visualizing a three dimensional model where five kinds of intellectual operations take place. These were: (1) cognition, (2) memory, (3) divergent production, (4) convergent production, and (5) evaluation. In order to solve a problem, it has to be recognized as a problem. There was a search of the memory for past ways of handling problems which might be applicable at the present time. Following this, the individual

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<sup>21</sup>John Dewey, The Child and the Curriculum (Chicago: University of Chicago Press, 1902), p. 13.

<sup>22</sup>John Dewey, School and Society, 2d ed. (Chicago: University of Chicago Press, 1915), pp. 10-20.

<sup>23</sup>John Dewey, Experiences and Education (New York: Macmillan, 1938), p. 23.

constructed new ideas from other sources at hand and brought each idea into focus to see if it would apply to the problem. Evaluation took place as each idea was considered and either accepted or discarded.<sup>24</sup>

According to Guilford, problem-solving and creativity were two of many aspects of intellectual activity. In order to resolve a problem a creative plan had to be instituted. First, the problem had to be recognized, new information sorted and a plan of action instigated.<sup>25</sup>

According to Taba, a student learned to solve problems by an interaction between the subject-matter to be learned and the learner.<sup>26</sup> Bruner emphasized that every discipline had to be learned according to its own structure. Such a structure coordinated facts, concepts, generalizations and principles into a meaningful relationship. When a curriculum was to be written Bruner found that each structure was to be explicitly explained to such a degree that the learner would understand every relationship without misunderstanding.<sup>27</sup>

To organize a learning experience in any curriculum the

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<sup>24</sup>J. P. Guilford, "The Structure of Intellect," Psychological Bulletin 53 (July, 1956): 267-93.

<sup>25</sup>J. P. Guilford, The Nature of Human Intelligence (New York: McGraw-Hill, 1967), p. 116.

<sup>26</sup>Taba, pp. 301-02.

<sup>27</sup>Jerome Bruner, The Process of Education (Cambridge, Massachusetts: Harvard University Press, 1960), p. 31.

criteria of continuity, sequence and integration needed to be met. The manner in which problem-solving skills was learned was no different. Continuity and sequence referred to longitudinal organization, whereas integration was concerned with horizontal organization. Tyler identified three elements which were common to all disciplines. These were: (1) concepts, (2) values, and (3) skills. According to Tyler, learning experiences should be planned around these elements for both longitudinal and horizontal organization. The desired changes in the learner's behavior and the content of the subject matter could be used to bring about these changes. As well as these elements, the social and natural environment of the learner, and the psychology and philosophy of education, must be utilized in planning the curriculum.<sup>28</sup> The principles of learning which Tyler emphasized were: (1) chronological sequence, (2) deduction, (3) induction, and (4) gradual progression from the immediate to the peripheral.<sup>29</sup>

Gagne felt that learning was cumulative in its effect. Progression occurred because the learner responded to various forms of stimulation from the environment. He was able to

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<sup>28</sup> Ralph W. Tyler, Basic Principles of Curriculum and Instruction, 31st ed. (Chicago: University of Chicago Press, 1950), pp. 55-64.

<sup>29</sup> Ralph W. Tyler, "Education for a More Workable and Just Society," paper presented at the Perry Dunlop Smith Memorial Lecture, Roosevelt University, Chicago, April, 1976.

combine old rules into new ones to arrive at a solution. To Gagne, problem-solving was the most advanced intellectual ability. In order to be able to problem-solve, the learner had to apply eight conditions of learning. These were:

(1) signal learning, (2) stimulus-response learning, (3) chaining, (4) verbal association, (5) discrimination learning, (6) concept learning, (7) rule learning, and (8) problem solving.<sup>30</sup> Gagne states that "Problem solving may be viewed as a process by which the learner discovers a combination of previously learned rules that he can apply to achieve a solution for a novel problem situation."<sup>31</sup>

Gagne's theory of learning followed the stimulus-response conditioning which was emphasized by the behavioral scientists. Skinner, as the leader of the movement, felt that persons learned complex behavior through reiteration of components. He defined such conditioning as "operant conditioning." The term operant referred to the property upon which conditioning was contingent. In a stimulated patient situation, the reinforcement depended upon the response of the learner. The consequences of such a response determined whether the same response would be made under similar conditions in the future. Behavior was shaped by reinforcing responses. Skinner emphasized that techniques

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<sup>30</sup>Robert M. Gagne, The Conditions of Learning, 2d ed. (New York: Holt, Rinehart & Winston, 1965), p. 35.

<sup>31</sup>Ibid., p. 214.



should be developed which maintained the desired behavior. Students needed to progress through a series of behaviors until the optimal behavior was achieved. According to Skinner, traditional methods of teaching lacked reinforcement.<sup>32</sup>

Despite many theories of learning, the literature was not clear about methods to teach problem-solving. Tyler emphasized that the desired response should be planned by educational authorities. Teachers had to establish an environment in which the student learned specific behaviors. These behaviors could be learned if the student practiced them consistently and received satisfaction from such repetition.<sup>33</sup>

#### Construction of Simulated Situations to Measure Problem-Solving

Simulated situations were constructed according to the behaviorist theories of learning. The simulations were written either on the basis of the learner's response to the situation or on the basis of the sequence of the responses in

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<sup>32</sup>Burrhus F. Skinner, Verbal Behavior (New York: Appleton-Century-Crofts, 1957), pp. 203-06.

<sup>33</sup>Tyler, "Education for a More Workable and Just Society," 1976.

the situation. If the former basis was chosen, the simulation was classified further into two categories. These were:

1. Constructed-Response Situations - This category enabled the student to supply the answer to the question. He had to respond overtly if the simulation was either on computer or in written form. In these types of simulations, the student must supply the actual answer himself either by punching the correct words in the computer or by writing out his answer in the blank space on the written form. If the situation was portrayed by an actor, the student responded covertly and followed his decision through by obtaining further information. By "covert" was meant that the student thought his decision through but did not write down actual words. In reality the student did think and act. According to Elstein et al., if the simulation situation was for measurement purposes, the examiner had to analyze the student's actions in order to assess the problem-solving ability.<sup>34</sup>

2. Multiple Choice Situations - Simulated situations in this category required the student to make several choices from a given list of answers. One or more appropriate

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<sup>34</sup>A. S. Elstein et al., "Methods and Theory in the Study of Medical Inquiry," Journal of Medical Education 47 (February, 1972):85-92.

answers were included and the student decided on the best one. He answered either covertly or overtly depending on whether the situation was a written or a live portrayal of the patient.<sup>35</sup>

The second basis of simulated situations was that of sequence. Again, there were two categories describing the type of sequence in a simulated situation. These were:

1. Linear Type Situations - Both of the above categories may be placed in a linear sequence. Because of the trend toward programming, simulated situations were constructed so that the student followed a constructive-response, linear type sequence by reading the first question, answering it and checking his answer for immediate feedback before continuing into the next aspect of the program.<sup>36</sup> In a multiple-choice, linear type sequence the student could choose an answer from several plausible ones. If it was the correct answer he continued selecting further answers. If the answer chosen was the incorrect one the student continued to choose other possible answers until the correct one was selected. Measurement of problem-solving ability in this case would be through the assessment of the number of answers

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<sup>35</sup>Howard Barrows, Simulated Patients (Springfield, Illinois: Thomas, 1972), p. 3.

<sup>36</sup>Arthur S. Blaiwes and Dennis R. Weller, "A Social Simulator: Development and Evaluation," Educational Technology 17 (March, 1977):14-20.

selected before reaching the correct decision.<sup>37</sup>

2. Branching Situations - This type of sequence used only the multiple-choice type of answers. The student was given a number of plausible answers to a question. In choosing one answer he would be able to choose further answers relating to his decision. Such a method allowed the student to think a situation through and follow a problem to its conclusion as he would have to do in a real-life setting.<sup>38</sup>

Although much has been written on both types of programs it was difficult to assess superiority of one over the other because of the lack of true experiments. Some authorities wrote that the branching type of sequence had the benefit of life-like situations in which once a decision was made it could not be retracted for a more desirable one.<sup>39</sup> Other authorities felt that the student remembered mistakes rather than the correct answers in a branching sequence.<sup>40</sup>

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<sup>37</sup>David Cram, Explaining "Teaching Machines" and Programming (San Francisco: Fearon, 1961), p. 26.

<sup>38</sup>Norman A. Crowder, "Automatic Tutoring by Intrinsic Programming," in Teaching Machines and Programmed Learning, eds. A. A. Lumsdaine and R. Glaser (Washington, D.C.: National Education Association, 1960), pp. 286-98.

<sup>39</sup>Harry F. Silberman, "Characteristics of Some Recent Studies of Instructional Methods," in Programmed Instruction and Computer-Based Instruction, ed. J. Coulson (New York: Wiley, 1962), pp. 13-24.

<sup>40</sup>Stuart Margulies and Lewis D. Eigen, Applied Programmed Instruction (New York: Wiley, 1962), p. 9.

O'Neill, Rasor and Bartz stated that "there is little agreement as to what type of feedback is most effective in terms of retention. . . .If one goal of testing is to have students retain correct answers even for a short period of time, the method of feedback may be a key variable."<sup>41</sup>

#### Timing of Feedback Upon Problem-Solving Ability

Use of the technique of simulation allowed the student to be informed of his actions. McGuire and Wezeman stated that "the total situation must be arranged so that each of the learner's activities triggers appropriate feedback that he can utilize in subsequent decisions."<sup>42</sup> In the constructive-response type of sequence the subject received immediate feedback. In the branching type of sequence the subject received feedback later after several other decisions has been made.

According to McGuigan, Crockett and Bolton, a subject's performance improved if he received immediate feedback. In their experiment, participants were to draw a line while

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<sup>41</sup>Marianne O'Neill, Richard A. Rasor and Wayne R. Bartz, "Immediate Retention of Objective Test Answers as a Function of Feedback Complexity," Journal of Educational Research 70 (December, 1976):72.

<sup>42</sup>Christine H. McGuire and Frederick H. Wezeman, "Simulation in Instruction and Evaluation in Medicine," in Educational Strategies for the Health Professions, eds. G. E. Miller and T. Fulop, WHO Public Health Paper, No. 61 (New York: World Health Organization, United Nations, 1974), p. 19.

blind-folded. They were given verbal feedback as to their ability, either immediately after they drew a line or twenty seconds following their action. The experimentors found that the sooner the candidates knew how they had performed the better they did the next time. Their performance was very poor when the participants received no feedback.<sup>43</sup>

Quiring was interested in measuring the performance of students who had received either immediate or delayed feedback. Seventy-two student nurses were videotaped during an initial performance of preparing an injection. The students were then randomized into one of three groups. These were: (1) immediate feedback, (2) delayed feedback, and (3) no feedback. Feedback consisted of viewing their own performances immediately after completing the task or of waiting one week to see the outcome. All students repeated their performance one week later. When the grades of the students were compared, the results indicated that there was no difference in performance of those students receiving either immediate or delayed feedback. Those students who did not receive any feedback did not perform well when they repeated their performance.<sup>44</sup>

Donaldson investigated a similar nursing problem.

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<sup>43</sup>F. J. McGuigan, Frances Crockett and Carolyn Bolton, "The Effect of Knowledge of Results Before and After a Response," Journal of General Psychology 63 (July, 1960): 51-55.

<sup>44</sup>Quiring, pp. 332-37.

Twenty-eight junior nursing students were videotaped during a nursing task. Randomized into three groups, the students were evaluated as to their performance after either receiving immediate feedback, delayed feedback or no feedback. The results of the experiment showed that there was little difference in the scores of the students. Immediate feedback did not seem to make a difference.<sup>45</sup>

Sechrist compared nurses' responses to a simulated situation by tape-recording their comments. The four groups were not randomized and consisted of undergraduates, graduates, public health nurses and nurse practitioners. The nursing task was to work with selected groups of patients prior to surgery. According to Sechrist, simulations did afford a technique which offered feedback to help the student learn responses from one patient to another.<sup>46</sup>

According to Gagne, feedback was extremely important to provide verification of a goal. He stated that "reinforcement "works" in human learning because the expectancy established during the motivational phase of learning is now confirmed during the feedback phase."<sup>47</sup>

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<sup>45</sup>Mary L. M. Donaldson, "The Videotape Recorder as a Tool for the Evaluation of Technical Nursing Skills" (Ph.D. dissertation, George Peabody College, 1974), P. 98.

<sup>46</sup>Karen R. Sechrist, "Comparison of Nurses' Responses to a Simulated Primary Care Situation." (Ph.D. dissertation, University of Pittsburgh, 1974), p. 67.

<sup>47</sup>Robert M. Gagne, Essentials of Learning for Instruction (Hinsdale, Illinois: Dryden, 1974), p. 45.

Simulations were constructed to help students acquire skills in problem-solving. In the health-care field the simulations were concerned with the student's ability to diagnose correctly a patient's diseases.

Use of Simulations  
to Measure Problem-  
Solving Ability

One of the earlier and more important experiments illustrating the use of simulations to measure problem-solving skills was the work of Glaser, Damrin and Gardner. These investigators developed a simulated situation in which measurement of a subject's ability to handle machinery was tested. The examinee was presented with a description of the problem, a series of ways to handle the equipment and a list of possible solutions to the problem. When sufficient information had been chosen the examinee selected his solution to the problem by uncovering the answers.<sup>48</sup>

Rimoldi also attempted to use simulation to measure diagnostic problem-solving in the medical field. The examinee was given a specific clinical situation and a series of cards on which were listed questions that could be asked. The candidate was evaluated by the number and sequence of the cards selected. In testing this simulated technique, 76 juniors and 120 seniors from five medical schools were

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<sup>48</sup>Robert Glaser, Dora E. Damrin and Floyd M. Gardner, "The Tab Item: A Technique for the Measurement of Proficiency in Diagnostic Problem-Solving Tasks," Educational and Psychological Measurement 14 (Summer, 1954):283-93.



selected and compared to a group of 40 physicians. The experimental group of medical students succeeded in answering the questions.<sup>49</sup>

Subsequent work to measure diagnostic skills led to the preparation and analysis of a group of tests measuring different aspects of problem-solving. According to Rimoldi et al., "The Test of Diagnostic Skills aims at exploring how a physician solves a clinical problem by analyzing the type and sequence of questions that he asks. . . .The technique is easily adapted to a variety of materials and the presentation can be controlled by the test designer."<sup>50</sup>

Cline used a series of color films simulating a physician interviewing a patient. After seeing the film the medical student answered a set of written questions concerning the situation. He was graded on his problem-solving ability according to the acceptable answers of a group of experts.<sup>51</sup> In a similar type of experiment, a tape recording of a psychiatrist interviewing a patient was utilized. The medical students listened to the tape and had to select a

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<sup>49</sup>H. J. A. Rimoldi, "A Technique for the Study of Problem-Solving," Educational and Psychological Measurement 15 (Winter, 1955):450-61.

<sup>50</sup>H.J.A. Rimoldi, John V. Haley, and H. Fogliatto, The Test of Diagnostic Skills (Chicago: Loyola University of Chicago, 1962), p. 3.

<sup>51</sup>Marvin G. Cline, "A Film Test of Clinical Skills in Medical Students," Journal of Medical Education 36 (August, 1961):908-13.

diagnosis.<sup>52</sup>

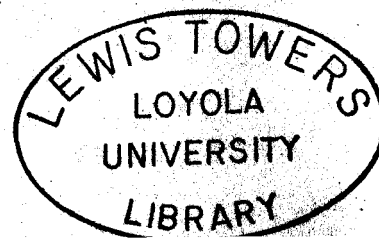
Role-play has been utilized to measure problem-solving ability in medical education. Barrows employed actors and actresses to role-play as patients in a simulated situation. They were given extensive, prior instruction to become adept as patients portraying medical symptoms. The medical students believed the actors were actual patients because the simulations were so realistic. The actors themselves were taught to look for types of responses made or omitted during the physical examination.<sup>53</sup>

In this type of simulated situation, the candidate was encouraged to pursue his own method of inquiry rather than select answers from a given list of solutions. Perhaps one of the best approaches to measuring diagnostic skills was introduced at the University of Illinois Medical School. Earlier techniques such as the Tab Method had measured the student in a "yes" or "no" format.<sup>54</sup> Using the multiple-choice, branching sequence, simulations could be written so that the examinee was able to make several choices. Written simulations could be standardized for all students, yet each candidate could make his own decisions leading to acceptable results. The simulations resembled clinical situations in which a student had to make various decisions depending on the

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<sup>53</sup>Barrows, pp. 1-60.

<sup>54</sup>Glaser, Damrin and Gardner, pp. 283-93.



patient involved. Once a decision has been made further choices would have to be selected based on the previous response.

In order to work through a sequence, the student had to follow the instructions implicitly to resolve the problem. If the student's choice of answers caused the patient's condition to deteriorate, alternative means of meeting the crisis could be chosen and the student assessed accordingly. Charvat, McGuire and Parsons stated that "Provision must be made for modifications in the problem as the patient responds to the specific courses of action chosen by the examinee."<sup>55</sup> One of the alternative choices might be the consultation of specialists from the specific field of health care.

Machen wrote three simulation patient situations to be used as an assessment tool for dentistry students. Following the guidelines of McGuire, he was interested in evaluating the validity and the reliability of the technique. Randomly dividing the undergraduate and graduate students, he administered the simulations alternating the format, sequence and order. The reliability of the three simulations ranged from .38 to .89 for the undergraduate students and .77 to .98 for the graduate students.<sup>56</sup>

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<sup>55</sup>Josef Charvat, Christine McGuire and Victor Parsons, A Review of the Nature and Uses of Examinations in Medical Education, WHO Public Health Paper, No. 36 (New York: World Health Organization, United Nations, 1968), p. 58.

<sup>56</sup>James B. Machen, "Simulation Techniques for the Measurement of Diagnostic Skill in Pedodontics," (Ph.D. dissertation, University of Iowa, 1974), p. 51.

These results showed that simulations were of value in assessing problem-solving skills in the field of health care. Boocock and Schild suggested that in other fields simulations were utilized without supporting evidence that the technique helped students achieve. In educational fields, for example, it was often impossible to randomize or match pairs of individuals in the classroom. The results of experiments were often negligible.<sup>57</sup>

It has been shown that simulation techniques have been used in the field of business management to assess a subject's ability to make decisions. According to Jaffee, simulations accorded a "certain stability of performance measured by these exercises that allows for the effective use of the instrument."<sup>58</sup>

### The Development of Higher Intellectual Abilities

Before planning curriculum action it was important to establish the types of objectives which the student was to attain. If problem-solving was to be part of the goal for the student, it should be incorporated into the curriculum.

According to Bloom et al., the educator needed to

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<sup>57</sup> Sarane S. Boocock and E. O. Schild, Games in Learning (Beverly Hills, California: Sage, 1968), p. 20.

<sup>58</sup> Cabot L. Jaffee, Effective Management Selection: The Analysis of Behavior by Simulation Techniques (Reading, Massachusetts: Addison-Wesley, 1971), p. 111.

develop a plan for the student based on the educational objectives of the curriculum.<sup>59</sup> In order to help the educator encourage development of intellectual abilities, Bloom et al. prepared a Taxonomy of Educational Objectives. This book helped to clarify levels of intellectual activity. The level of knowledge in Handbook I: The Cognitive Domain was regarded as the lowest level of mental ability. Without recall of facts the practical nurse involved in a Pharmacology and Medication Administration Program would not be able to attain higher levels of cognitive skills to solve problems.

The second level of the Taxonomy was that of comprehension which meant to understand what was heard and read. Various ideas needed to be related as well as translating these ideas into significant data.

Application was the third level of the Taxonomy. The practical nurse was expected to take a problematic situation and apply the principles of pharmacology and nursing to solve the problem.

The fourth level was that of analysis. This aspect referred to the student's ability to break down given material into definite parts as a prelude to problem-solving. For the purpose of this investigation, these four levels of intellectual activities were studied. Knowledge was considered as a

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<sup>59</sup>Bloom et al., p. 25.

lower mental process. Comprehension, application and analysis were considered as higher levels of mental ability.

The written simulated patient situations used in this investigation were designed to help practical nurses learn problem-solving skills. Mager stated that "an objective is a statement of what the learner is to be like when he has successfully completed a learning experience."<sup>60</sup> The simulation, because of immediate feedback, assisted the practical nurse to evaluate her own performance. According to Gronlund, the learning process must move from the teacher to the student. Written simulated situations were an attempt for the practical nurse to become involved in her own learning.<sup>61</sup>

A medication nurse is expected to fulfill a job and problem-solving is part of that job.<sup>62</sup> Simulated patient situations could be a teaching strategy to help the practical nurse develop the necessary skills to perform competently on the job.

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<sup>60</sup>Robert F. Mager, Preparing Instructional Objectives (Belmont, California: Fearon, 1962), p. 3.

<sup>61</sup>Norman E. Gronlund, Stating Behavioral Objectives for Classroom Instruction, 6th ed. (New York: Macmillan, 1972), p. 7.

<sup>62</sup>Keithley, p. 3.

## CHAPTER III

### RESEARCH DESIGN

#### Subjects

The sample consisted of licensed, practical nurses participating in a Pharmacology and Medication Administration Program. This Program was offered as a continuing education program for licensed practical nurses. These nurses worked in hospitals and other health-care facilities within the metropolitan area of Chicago, Illinois. These institutions required their practical nurses to receive a certificate of achievement in order to administer medications.

The practical nurses were working in many different hospitals located throughout the city of Chicago and traveled to the classroom location. The Program was offered in two centrally located hospitals. Choice of the classroom site was dependent on which days the specific hospital wished a practical nurse to attend class and the available classroom space.

The following variables were noted and controlled as covariates in the analysis of the data. These were:

1. Age - In the past, the ages of the practical nurses enrolled in the Program ranged from eighteen through fifty-five years. The covariate "age" was considered as:

- a) Young: 18 - 29 years
- b) Middle: 30 - 45 years
- c) Older: 46 - 55 years.

2. Years of Nursing Experience - Nursing experience of those practical nurses enrolled in the Program previously ranged from no experience to twelve years of nursing experience. This covariate was studied because of the varying experiences encountered by the practical nurses. A difference in problem-solving ability could be due to other experiences that the nurses may have had during their previous nursing tasks rather than those encountered during the Pharmacology Program. The covariate "experience" was considered as:

- a) Limited: Under 1 year
- b) Medium: 1 - 5 years
- c) High: 6 - 12+ years.

3. Length of Study Time - All the practical nurses enrolled in the Pharmacology and Medication Administration Program were required to receive a certificate of achievement in order to administer medications. Because of this pressure from the administration of the hospital in which they work, each practical nurse should be motivated to study the given assignments. In the past, it has been noted that some of the nurses spend up to five hours a day in study. Others devote less time to study each day. The covariate "hours of study-time per day" was considered as:



- a) Limited: Under 1 hour
- b) Medium: 1 - 2 hours
- c) High: 3 - 4+ hours.

4. Pretest - The final covariate considered in the analysis of the data was the pretest. There was no problem-solving scores available at the beginning of the Pharmacology and Medication Administration Program. Therefore, an examination was given as a pretest to study problem-solving ability of the practical nurse before attending the Pharmacology Program. The same examination was given as a posttest to measure the problem-solving ability at the end of the Program. This examination is discussed in the section under Materials. The covariate "pretest" was controlled in the analysis of the data.

The variable "sex" was not considered as a covariate, as only women were included in the investigation. Few men enroll in the nursing program. Also, variables of race, intelligence quotient, marital status and number of children were not considered. All the practical nurses were chosen by their respective hospitals to attend the classes.

The two classroom sites were centrally located within the City of Chicago. The practical nurses attended one of the classes according to the specific day on which the hospital wishes attendance. Each intact classroom had an equal chance of being chosen to be the experimental or the control group. The two classrooms were numbered and the

numbers placed in a hat. The number chosen first was designated as the experimental group. The remaining number was designated as the control group. Both groups were taught by a team of registered nurses and pharmacists who followed a specific outline, so that the content of the Program should have been presented equally, or nearly equally, to both groups. Each class was of three hours duration so that both groups should receive an equal amount of lectures irrespective of the class attended.

### Materials

During the Pharmacology and Medication Administration Program, each practical nurse in both the experimental group and the control group received a list of terminal outcomes and specific textbook.<sup>1</sup> Additional materials were given before each lecture. These were: (1) an outline for pharmacology or nursing, (2) a list of objectives written in behavioral terms, and (3) a number of handouts for each section.

Both the experimental group and the control group were taught according to the traditional method which was in the form of lectures. These classes were offered by the same team of registered pharmacists and nurses and followed a specific outline. According to Taba, the traditional method

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<sup>1</sup>Govoni and Hayes, 1965.

of teaching was an expository method in which the teacher usually lectured and asked questions. Students responded by listening, answering questions and asking other questions.<sup>2</sup>

In the control group, the practical nurses were not given any further help. They were expected to listen to the presentations, ask questions in class and read the assigned materials. These nurses were not given any feedback if presented with a medication problem. The control group was expected to think a problem through and decide on an appropriate nursing action after reading the assigned materials.

The nurses in the experimental group received all the above materials and, in addition, received a series of simulated patient situations dealing with the administration of medications.

Instrument I:  
Simulated Patient Situations

The investigator developed a series of simulated patient situations in a pencil and paper format. These situations dealt with the administration of medications and were drawn up according to the plan suggested by McGuire, Solomon and Bashook.<sup>3</sup>

The first step involved selecting the content for each situation according to the curriculum of the Pharmacology

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<sup>2</sup>Taba, pp. 301-02.

<sup>3</sup>McGuire, Solomon and Bashook, Construction and Use of Written Simulations, p. 24.

Program. This involved writing general and specific objectives for each situation. The second step was to outline each situation as to characters to be involved, sequences to be followed and decisions to be made by the nurse. Each situation was written as if the medication nurse were to experience a life-like problem. Each situation consisted of a patient with a specific disease and to whom certain medications were to be given. Problems associated with the medications were presented according to similar situations in a real-life experience. Each area of the situation was written in explicit terms so that each section appeared plausible.

After setting up the main sections of the situations, several optional routes were written to allow the student who selected various actions, to follow the chosen path to its conclusions. In order to connect one section to another, bridges were written. According to Berner and Nerenberg, linear bridges occurred when one choice naturally followed another. If the practical nurse was able to select her own route through the situation, free branching bridges were written. If the situation called for a definite course of action, the bridge was written to force the participant to follow in that direction.<sup>4</sup> Finally, the whole situation was reviewed for plausibility, grammatical accuracy and unintended cueing.<sup>5</sup>

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<sup>4</sup>Berner and Nerenberg, The Construction of Written Simulations, 1975.

<sup>5</sup>See Example in Appendix B.

After completion, the simulations were edited by five judges, graduates of accredited schools of pharmacy and professional nursing. All judges were currently working in the preparation or administration of medications and were familiar with present-day medications as well as various hospital policies concerning patient care.

The five judges were told the purpose of the simulations and were given a brief introduction to the technique by the investigator. Each judge separately rated all options in the simulations using the five point scale as advocated by McGuire, Solomon and Bashook. This scale numerically rated each option according to whether the choice of action was appropriate to the care of the patient or would be harmful.<sup>6</sup> The need for each judge to rate each decision was to make appropriate choices for both the pharmacological and nursing implications.

According to McGuire and Babbott, the group of experts in the relevant speciality should "identify numerically the various combinations of choices that constitute skilled management and those that represent merely adequate, or even totally inadequate care of the patient."<sup>7</sup>

When three of the five judges agreed on an option, the choice was retained. If there was no consensus, the choice

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<sup>6</sup>McGuire, Solomon and Bashook, Construction and Use of Written Simulations, p. 62.

<sup>7</sup>McGuire and Babbott, "Simulations Techniques in the Measurement of Problem-Solving Skills," p. 5.

was either discarded or rewritten by the investigator. The five judges were then asked to rate the options that had been rewritten. If there was no consensus, the option was discarded. If three of the five judges agreed on the choice the option was retained.<sup>8</sup>

The reading level of the simulated patient situations was then assessed by a group of four practical nurses who had previously taken a Pharmacology Program and were familiar with the terminology of the speciality. Words which were difficult to understand were then rewritten by the investigator and reassessed by the practical nurses.

For the purpose of this investigation, the written simulations were used as a teaching strategy. The experimental group received these situations in two stages. These were: (1) following the oral medication lectures and (2) following the injection therapy lectures. A brief explanation was given as to the use of the A. B. Dick Developer pen and the latent image process sheet. The practical nurses used this pen in order to bring out the invisible answers which had been typed on to the answer sheet. Because many handouts were given to the nurses before each lecture, the practical nurses were not aware that the written simulations are experimental.

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<sup>8</sup>See Example in Appendix C.

Instrument II:  
Daily Study Time Record

In order to analyze the amount of study time for each group of practical nurses, a daily study time record was maintained. This record was adapted from that of Purcell.<sup>9</sup>

The practical nurse was to record on this sheet the number of minutes of study time per day, either by herself, with a classmate, with a registered nurse or in any other manner. The record was collected at the end of each week. The total number of minutes per day was added so that at the end of the ten weeks, the total amount of study time could be analyzed.<sup>10</sup>

Instrument III:  
Pretest and Posttest

The Pharmacology and Medication Administration Program was organized by an Advisory Committee representing eight Chicago hospitals. An ad hoc committee established the standards for the Program.

In accordance with those standards a multiple-choice, 150 item examination was developed. This examination contained items relative to the content of the Program. The

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<sup>9</sup>John B. Purcell, "The Effect of Daily Vocational Quizzes on Motivation" (Ed.D. dissertation, Loyola University of Chicago, 1974):114.

<sup>10</sup>See Example in Appendix D.

test items also were written according to the Taxonomy of Educational Objectives: Handbook I: The Cognitive Domain.<sup>11</sup>

The first four levels were utilized. As the ad hoc committee had specifically identified both the pharmacological and nursing administration aspects of the Pharmacology Program the items in the examination were written from the content of the Program as shown in the syllabus. This examination was designated as Instrument III. The examination was given as a pretest on the first day of class. The examination was also given on the last day of class as a posttest in order to compare the problem-solving ability scores of the practical nurses from the beginning of the Pharmacology Program to the end.

#### Pilot Study

In order to seek information regarding the plausibility of the instruments to be used in the investigation a pilot study was conducted. The experimental group consisted of six nurses enrolled in the Pharmacology Program at one hospital site. The control group consisted of six nurses attending the other hospital location. These practical nurses were similar in ages, backgrounds and years of experience to those who participated in the experiment.

Instrument I, the simulated patient situations, was

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<sup>10</sup>See Example in Appendix D.

<sup>11</sup>Bloom et al., 1956.



given to those nurses in the experimental group in two stages. Instrument II, the daily study-time record was given to both groups. Instrument III was given to both groups and pertinent data relevant to the examination's outcomes were studied and reported. Two of these outcomes were reliability and validity.

1. Reliability - According to French and Michael, "reliability refers to the accuracy . . . of measurement of a test."<sup>12</sup> An analysis of Instrument III will be accomplished by the use of the Kuder-Richardson Formula 20 on each examination item and at each level of the Taxonomy. According to Guilford,<sup>13</sup> this formula was:

$$r_{tt} = \left( \frac{n}{n - 1} \right) \left( \frac{\overset{2}{\sigma}_t^2 - pq}{\underset{t}{\sigma}_t^2} \right)$$

The Standard Error of Measurement also was calculated for this examination. According to Kerlinger,<sup>14</sup> this

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<sup>12</sup>John W. French and William B. Michael, Standards for Educational and Psychological Tests and Manuals, (Washington, D.C.: American Psychological Association, 1966), p. 25.

<sup>13</sup>J. P. Guilford, Psychometric Methods, 2 ed. (New York: McGraw-Hill, 1954), p. 380.

<sup>14</sup>Fred N. Kerlinger, Foundations of Behavioral Research, 2d ed. (New York: Holt, Rinehart Winston, 1973), p. 441.

formula was:

$$SE_{\text{meas}} = SD_t \sqrt{1 - r_{tt}}$$

2. Validity - Kerlinger stated that "The commonest definition of validity is epitomized by the question: Are we measuring what we think we are measuring? The emphasis in this question is on what is being measured."<sup>15</sup> The aspects of validity to be considered were those of content validity and construct validity.

a. Content validity - Cronbach stated that content validity may be established according to the descriptions of the necessary skills and attitudes needed.<sup>16</sup> According to French and Michael, "The aptitudes, skills and knowledges required of the student for successful test performances must be precisely the types of aptitudes, skills and knowledges that the school wishes to develop . . . and evaluate . . . in test scores."<sup>17</sup>

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<sup>15</sup>Ibid., p. 457.

<sup>16</sup>Lee J. Cronbach, Essentials of Psychological Testing. 3rd ed. (New York: Harper & Row, 1970), p. 123.

<sup>17</sup>French and Michael, p. 13.

For the purpose of this investigation an item analysis was conducted by the investigator on Instrument III. Each test item was examined scrupulously against the content of the Pharmacology Program as stated in the syllabus. The panel of five judges who had previously rated the simulated patient situations, separately studied Instrument III and found that the test items did measure the content of the Pharmacology and Medication Administration Program. Cronbach and Meehl stated that "test items are a sample of the universe in which the content is done deductively by defining a universe of items and sampling systematically within this universe."<sup>18</sup>

b) Construct validity - According to Kerlinger, construct validity referred to the psychological properties within a test. In order to differentiate exact properties Kerlinger suggested the use of factor analysis. He stated that "It is a method for reducing a large number of measures that go together."<sup>19</sup> The purpose of this investigation was to analyze the performance of the practical nurses on

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<sup>18</sup>Lee J. Cronbach and P.E. Meehl, "Construct Validity in Psychological Tests," Psychological Bulletin, 52 (July, 1955):282.

<sup>19</sup>Kerlinger, p. 468.

Instrument III according to the Taxonomy of Educational Objectives: Handbook I: Cognitive Domain.<sup>20</sup> Although the test items were written according to the first four levels of the Taxonomy, a factor analysis was conducted on Instrument III to determine the properties being tested. Items that do not measure the first four levels of the Taxonomy were discarded in the analysis of the data. Only one form of Instrument III was used.

### Procedures

This investigation utilized the Nonequivalent Control Group design. This is designated a quasi-experimental design because the subjects were not randomized to treatments. According to Campbell and Stanley, this design "should be recognized as well worth using when . . . [true designs] are impossible."<sup>21</sup> In this investigation the groups were already assembled as intact classes and could not be randomized. With this design, the treatment was randomly assigned to the groups.

One of the conditions for use with this design was that all the subjects come from the same population. In order to enroll in the Pharmacology and Medication Administration

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<sup>20</sup> Bloom et al., pp. 62-161.

<sup>21</sup> Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-experimental Designs for Research (Chicago: Rand McNally, 1963), p. 47.

Program all the practical nurses had to be employed in hospitals which required a certificate of achievement in order for the practical nurse to administer medications. As described under Subjects, selected variables were adjusted as covariates and the resulting scores analyzed.

With this research design there were certain threats to internal validity. The first one was that of regression. According to Campbell and Stanley, this problem may be carefully screened prior to the experiment. Because the groups did not have equivalent pretest scores, an analysis of covariance was used to adjust differences between subjects. Then the treatment was randomly assigned to the groups.

The second threat to validity was the interaction of selection and maturation. A gain in test scores may have been the result of factors other than the treatment. This type of gain often occurred in psychiatric settings. Persons involved as subjects may have become well in spite of the treatment rather than because of it. Campbell and Stanley suggested the use of the Analysis of Covariance to eliminate factors which might have caused incorrect statistical treatment.

The above problems should not affect the design, because Instrument III was required as a pretest for all practical nurses enrolled in the Pharmacology Program. Following this

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<sup>22</sup>Ibid., p. 48.

examination, quizzes were administered throughout the Program to both groups. The tests were the same for both groups so that the participants were not aware that they were part of a study. The lectures were presented to both groups by a team of registered pharmacists and nurses who lectured from an outline. All handouts, including the simulations, were administered by the investigator so that the lecturers were not aware which class was the experimental or control group.

The Nonequivalent Control Group design also had certain threats to external validity. Generalizing this experiment to other populations may not be possible, since this study utilized a pretest. Other Pharmacology Programs for practical nurses may not require such an examination.

A second threat to external validity was the effect of the pretest upon the nurses enrolled in the Program.<sup>23</sup> Both the experimental group and the control group received Instrument III as a pretest in the first lecture period. Following this examination, quizzes were administered so that the participants wrote many examinations during the course of the Program.

A third threat to external validity was the fact that the experiment was conducted in a special setting. The participants may have realized that they were part of an

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<sup>23</sup>Ibid., p. 50.

experiment and their behavior may have improved or deteriorated accordingly. In this investigation, the practical nurses were studying in a classroom located within a hospital. Both groups had to travel to the site but their experiences during the Program were the type of classroom and hospital experiences they have had in previous educational programs.

### Tests of significance

The statistical procedure involved was the Analysis of Covariance, to help control differences in the groups.<sup>24</sup> This procedure was similar to the Analysis of Variance but specific differences were adjusted as covariates and controlled statistically. This control utilized correlations between the variables. The scores of the two groups were then analyzed. Since the differences had been removed the groups should be similar.<sup>25</sup> According to Edwards, the use of this technique was applicable "where the matching of groups is not feasible prior to the assignment . . . but where some measure of initial performance may be obtained after the assignment."<sup>26</sup>

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<sup>24</sup>William L. Hays, Statistics for the Social Sciences, 2d ed. (New York: Holt, Rinehart & Winston, 1973), p. 655.

<sup>25</sup>Deobold B. Van Dalen, Understanding Educational Research, 3d ed. (New York: McGraw-Hill, 1973), p. 277.

<sup>26</sup>A.L. Edwards, Experimental Design in Psychological Research, (New York: Holt, 1950), p. 355.

There were four assumptions of the Analysis of Covariance. These were that the population was (1) normally distributed, (2) independent, (3) linear and (4) homogenous. The rationale behind these assumptions was that since the difference had been adjusted the subjects were now similar. Analysis of Covariance was based on regression analysis; it was used when assumptions of normality and homogeneity have been met.<sup>27</sup>

Normality referred to the experimental errors that were distributed throughout the population. With the Analysis of Covariance a moderate departure from such normality may be experienced. Independence of sample means and variances referred to the fact that the population from which the sample of practical nurses were taken, were normally distributed.

According to Hays, the model for simple analysis of covariance "is a direct extension of the model of linear regression. . . . Within each treatment population, the relationship . . . is linear and has the same regression coefficient."<sup>28</sup>

Following the Analysis of Covariance procedure the significant univariate main effects were tested by the "F" test and the Chi Square test.

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<sup>27</sup>Kirk, p. 458.

<sup>28</sup>Hays, p. 655.



The "F" test was a ratio between the among groups sum of products and the within groups sum of products. The ratio was computed by dividing the error mean product by the error mean squares product.<sup>29</sup>

The Chi Square test was computed by the following formula:

$$\sum_{i=1}^k \frac{(f_i - F)^2}{F_i}$$

where k = number of categories

where f = unobserved frequencies

F = theoretical frequencies

This procedure was used to test whether the observed frequencies agreed with the theoretical frequencies in the number of categories. According to Kirk, "F is a random variable formed from the ratio of two independent chi-square variables, each divided by its degrees of freedom, therefore the assumptions of the  $\chi^2$  are also the assumptions of F."<sup>30</sup>

For the purpose of this investigation an alpha level of .05 was chosen as the decision rule for rejection of each

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<sup>29</sup>Kirk, p. 467.

<sup>30</sup>Ibid., p. 43.

null hypothesis. This level of significance was chosen because of the probability of a Type I error was lower than a Type II error. Hays suggested that the sample size be as large as possible in order to increase the power of the test.<sup>31</sup>

### Null Hypotheses

Corresponding to each null hypotheses stated in Chapter I, the Analysis of Covariance procedure was utilized.

Hypothesis 1: There will be no difference in the problem-solving scores on a posttest for practical nurses who receive simulated patient situations and for practical nurses who receive traditional methods of teaching.

This hypothesis was non-directional and was analyzed by the Analysis of Covariance. The scores of the experimental group were compared with the scores of the control group, using Instrument III as a posttest.

Hypothesis 2: There will be no difference in problem-solving scores for practical nurses who receive simulated patient situations and practical nurses who receive traditional methods of teaching by amount of time spent in studying.

This hypothesis was non-directional and was analyzed by

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<sup>31</sup>Hays, p. 360.

the Analysis of Covariance to compare the amount of study time both the experimental group and the control group listed on the 'Daily Study-Time Record.

Hypothesis 3A: There will be no difference in the problem-solving scores for practical nurses who receive traditional methods of teaching according to age.

Hypothesis 3B: There will be no difference in the problem-solving scores for practical nurses who receive simulated patient situations and practical nurses who receive traditional methods of teaching according to years of prior nursing experience.

Both of these hypotheses are non-directional and were analyzed by the Analysis of Covariance to compare the students with varying ages and differing years of prior nursing experience.

Hypothesis 4: There will be no difference in the development of lower as well as higher mental processes for practical nurses who receive traditional methods of teaching.

This hypothesis was non-directional and was analyzed by the Analysis of Covariance to compare all scores of both groups according to the first four levels of the Taxonomy of Educational Objectives.<sup>32</sup> Knowledge was considered the lowest level and comprehension, application and analysis were considered as higher levels.

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<sup>32</sup> Bloom, et al., pp. 62-161.

## CHAPTER IV

### FINDINGS AND INTERPRETATION

#### Instrument Development and Construction

In this chapter the findings of this quasi-experiment were presented and interpreted. The design was the Non-equivalent Control Group Design involving the use of two groups of practical nurses participating in a Pharmacology and Medication Administration Program.<sup>1</sup>

#### Construction of Instrument I: Written Simulated Patient Situations

For the purpose of this investigation a series of simulated patient situations were developed according to the methods advocated by McGuire, Solomon and Bashook.<sup>2</sup> These situations dealt with the practical nurse administering medications to patients with specific pharmacology and nursing problems.

These situations were written to resemble actual hospital experiences, in which the nurse had to make various decisions as to the kind of nursing care needed for the

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<sup>1</sup>Campbell and Stanley, pp. 47-50.

<sup>2</sup>McGuire, Solomon and Bashook, Construction and Use of Written Simulations, 1976.

particular patient. Although the beginning simulations demanded that the practical nurse follow a direct nursing action, the series developed into more complicated types of situations in which several choices could be made and which all led to a "correct" solution in the care of the patient.

The investigator also attended a workshop under the auspices of the University of Illinois at the Medical Center, Chicago. With the leadership of Berner and Nerenberg of the College of Medical Education, the mechanics of written simulated patient situations were further developed.<sup>3</sup>

After the series was completed five judges checked the subject matter for problems of omissions, redundancies and implausible answers.<sup>4</sup> The situations were then given to a group of four licensed practical nurses who checked for working, cueing errors and typographical errors.

The latent image process was used for the answer sheet. This process was developed by the A.B. Dick Company. The "invisible" answers were typed on to a special latent image transfer sheet. When the student chose an answer a special pen was used to bring out the desired response. Several problems occurred while preparing the simulations. The

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<sup>3</sup>Berner and Nerenberg, "The Construction of Written Simulation Problems," 1975.

<sup>4</sup>See Appendix C for Judges' Rating of the Simulations.

latent image transfer sheet dried quickly so that all the answers had to be typed several times and run off the spirit master 'immediately as each page was typed. Some of the "developer pens" dried after one situation making it difficult for some of the nurses to finish the work at home.

#### Construction of Instrument II: Daily Study Time Record

Each practical nurse was given a form to record the amount of time spent in daily study. This study time could have been alone, with classmates, with a registered nurse or any other person, and was to be recorded in minutes per day. At the end of each week, the record was collected and a new form was given to the nurse for the next week. A total of ten forms were given to the nurses, corresponding with the number of weeks of the continuing education program.<sup>5</sup>

#### Construction of Instrument III; Pretest and Posttest

Prior to the experiment an examination, designated as Instrument III, was prepared by the investigator for the purpose of analyzing the scores prior to taking the course, and the achievement of the nurses after a Pharmacology and Medication Administration Program had been completed. This examination contained 150, multiple-choice items relative

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<sup>5</sup>See Appendix D for an example of the Daily Study Time Record.

to the content of such a Program of study. This Pharmacology Program had been organized by an Advisory Committee representing eight Chicago hospitals. An ad hoc committee from those hospitals established the standards for the Program. Instrument III was specifically written according to those standards for both pharmacology and nursing. The test items were also written in accordance with the Taxonomy of Educational Objectives: Handbook I: The Cognitive Domain.<sup>6</sup>

The first four levels were utilized. Knowledge was considered to be the lowest level of mental activity and comprehension, application and analysis were considered to be higher levels of intellectual activity.

#### Conducting the Pilot Study

In order to seek information regarding the plausibility of the instruments to be used in the investigation, a pilot study was conducted. The experimental group consisted of six nurses enrolled in the Pharmacology Program at one hospital site. The control group consisted of six nurses attending another hospital location. The practical nurses in the experimental and control groups were similar by age, years of previous nursing experience and work responsibilities. All the pilot study nurses were representative of those practical

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<sup>6</sup>Bloom et al., 1956.

nurses who would be participating in the experiment.

The practical nurses in the pilot study were administered each of the instruments as described in the section concerning instrumentation. After the pilot study, Instrument III was analyzed as to the reliability and validity of the examination.

1. Reliability - To assess the reliability coefficient, the examination was subjected to the Kuder-Richardson Formula 20 on each examination item and at each level of the Taxonomy. The reliability coefficient was .69 for the total test. Earlier, the examination had been given to two other groups of practical nurses and had yielded a total test coefficient of .83 and .84 respectively. Kerlinger stated that "the smaller the sample the larger the error."<sup>7</sup> In the pilot study twelve nurses participated, while earlier groups were comprised of fifty students. The Standard Error Measurement of 3.52 was also calculated from the results of the pilot study data, as Table 1 depicted.

2. Validity - Instrument III was also analyzed for two aspects of validity, that of content validity and of construct validity.

a) Content validity - This aspect was ascertained with

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<sup>7</sup>Kerlinger, p. 61.



TABLE 1

RELIABILITY COEFFICIENTS AND STANDARD ERROR OF  
 MEASUREMENT OF TEST ITEMS ON FOUR LEVELS OF  
 BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES:  
HANDBOOK I: THE COGNITIVE DOMAIN

LEVEL NAME	KR <sub>20</sub> <sup>a</sup>	SE <sub>m</sub> <sup>b</sup>
Total	.69	3.52
Knowledge	.92	1.79
Comprehension	.72	3.22
Application	.68	3.58
Analysis	.71	3.39

Note:

a: KR<sub>20</sub> = Kuder Richardson Formula 20

b: SE<sub>m</sub> = Standard Error of Measurement

the help of those five judges who had previously analyzed the simulated patient situations. Independently checking each item against the content of the Program, the judges found that the examination did measure what it was supposed to measure as far as the content of the Pharmacology Program was concerned. An item analysis was also conducted by the investigator. An item analysis sheet recorded the twelve students choice of answers. If the difficulty index was either below .25 or above .80 that specific item was considered inadequate and was discarded. Again, the sample size was small but had been randomly selected from a larger population. Van Dalen states that "A 'good' sample must be as nearly representative of the entire population as possible."<sup>8</sup> The standard deviation of the pilot study groups was 6.2 for the experimental group and 6.4 for the control group.

b) Construct validity - This aspect of validity was concerned with the psychological properties to be measured. Instrument III was constructed to measure problem-solving abilities as well as knowledge of subject matter. The four levels of the Taxonomy of Educational Objectives: Handbook I: The Cognitive Domain were considered in writing the examination items.<sup>9</sup>

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<sup>8</sup>Van Dalen, p. 320.

<sup>9</sup>Bloom, et al., 1956.

In order to determine how many test items corresponded with the Taxonomy, Instrument III was subjected to a factor analysis. Of the original 150 items, 80 measured the lowest mental ability - that of knowledge. The remaining 70 items measured the next three levels of the Taxonomy. The level of analysis was the highest level of mental ability to be measured.

As well as the first four levels of the Taxonomy, the factor analysis discriminated specific subtotal levels of mental ability within the various levels. Table 2 showed the distribution of the test items for both total and subtotal items.

#### Design of the Experiment

Various experimental designs were studied in order to choose an appropriate design for this investigation. Campbell and Stanley examined sixteen designs.<sup>10</sup> The most suitable design for this experiment was the Nonequivalent Control Group design. According to Campbell and Stanley, this design was designated as a quasi-experimental design. It controlled for seven out of the eight factors related to internal validity. Because of the lack of randomization it did not control for selection of students and the growth of the students during the experiment. A gain in scores may have occurred from

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<sup>10</sup>Campbell and Stanley, 1973.

TABLE 2

DISTRIBUTION OF TEST ITEMS ON FOUR LEVELS WITH SEVEN SUBTOTALS  
OF BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES  
HANDBOOK I: THE COGNITIVE DOMAIN

LEVEL AND SUBTOTAL NAME	NUMBER OF TEST ITEMS - TOTAL
1.00 Knowledge	80
Knowledge of Facts	55
Knowledge of Trends	25
2.00 Comprehension	30
Translation	19
Interpretation	11
3.00 Application	9
4.00 Analysis	31
Analysis of Elements	23
Analysis of Relationships	8
	<hr/> 150

situations other than the experimental setting. This design did not control for external validity.

### Subjects

The investigation was directed at a Pharmacology and Medication Program, given specifically as a continuing education course for licensed practical nurses. These nurses were working in various hospital and health-care institutions throughout the metropolitan area of Chicago. One hundred nurses were to participate, with fifty nurses in the experimental group and fifty in the control group. One nurse in the experimental group dropped out of the Program leaving forty-nine nurses as part of the experimental group. The scores of the two male nurses in the control group were not considered in the data. One female nurse dropped out of the control group leaving a total of forty-seven nurses as the control group. A total of ninety-six practical nurses participated in the experiment.

At the first session of the Pharmacology Program, all nurses were given the pretest of Instrument III, to measure the initial performance of both the experimental group and the control group. The same content in pharmacology and in nursing administration was given to all nurses enrolled in the Program. Before each lecturer spoke, each nurse was given an outline for both nursing and pharmacology. Each lesson was presented to both groups from the same outline and given in an expository manner. The lecturer presented the material, answered

questions from the nurses and expected the handouts and the textbook to be read. All the practical nurses were informed that at the end of each unit they would be given a test on the previous lecture material. At the end of the formal classes, the posttest of Instrument III was given to both groups. This was to measure the achievement of the practical nurses.

In addition to the foregoing materials, the experimental group also received Instrument I, the series of simulated patient situations. As soon as the instructor had demonstrated the technique of giving oral medications, or of preparing and administering injection therapy, the nurses received the respective simulation relating to the area under discussion. The simulations were given with the idea of helping the practical nurses learn to solve problems while in a learning situation, rather than waiting to be confronted with such problems after completion of the Pharmacology Program.

Collection of data was a continuous process. It started before, and continued throughout the period of the experiment. Data were collected about the nurses' ages, previous nursing experience, and the length of daily study time.

#### Conducting the Experiment

The experiment involved two hospital locations where the Pharmacology and Medication Administration Program was being taught. The period of teaching was ten weeks including testing time. The practical nurses studied both pharmacology and

nursing administration. All the nurses enrolled in the Program were taught by the same team of registered pharmacists and nurses.

The registered pharmacists and nurses were defined as graduates of accredited Colleges of Pharmacy or Nursing. The team members were proficient in dealing with medications and in patient care, therefore, were competent to teach pharmacology and nursing care. These team members were not aware that a group of practical nurses was involved as an experimental group. Their task was to present the material in lectures as planned.

Only the investigator knew which group was involved as the experimental group. This was because the investigator was responsible for the administration of the two groups of practical nurses. The experimental group received the simulated patient situations along with the other handouts after each series of lectures. Other administrative tasks with which the investigator was involved during the experiment was to administer the tests and to collect the assigned homework.

#### Analysis of the Data

The nurses' data were continuously gathered and analyzed by the investigator during the entire experiment. Analysis of Covariance was used to test the hypotheses of the study. Kirk states that "An alternative approach to reducing experimental error and obtaining unbiased estimates of

treatment effects involves the use of statistical control. This latter approach also enables an experimenter to remove potential sources of bias from an experiment, biases that are difficult or impossible to eliminate by experimental control."<sup>11</sup>

Analysis of Covariance statistically controlled initial differences between groups. This was done by adjusting the scores on the posttest for those on the pretest. The differences on the posttest presumably reflected the result of the kind of teaching materials used in the experiment.

### Presentation of the Results

The procedure used in presenting the results of the analysis was as follows:

1. The univariate main effects of the nurses' scores on the total, subtotal and clusters of test items were reported and discussed. These items measured the desired educational objectives. The alpha level of .05 was chosen as the minimum level of significance.

2. The significant univariate main effects were tested by the F Ratio and the Chi Square. Unless these two tests showed statistically significant figures, the significance of the univariate main effects was not established.

3. The error correlation matrix on the performance of

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<sup>11</sup>Kirk, p. 455.



the ninety-six practical nurses on the two tests was presented and discussed.

#### The Performance of Ninety-six Nurses on the Posttest After Adjustments for Three Covariates

There were ninety-six practical nurses involved in the experiment. The scores of these nurses on the posttest were adjusted for the nurses' ages, the time spent in daily study and the performance on the pretest. Years of previous nursing experience were analyzed separately and presented later in the study. The three covariates were presented in Table 3 and 4 and showed the results of the Analysis of Covariance. Table 3 showed the univariate main effects of the total and subtotal scores of the ninety-six nurses on the posttest, after adjustments for the three covariates.

Although the total performance of the experimental group on the posttest exceeded that of the control group, the differences between the performances of the two groups were not statistically significant. The two variates were the experimental group and the control group.

When the subtotal scores were analyzed there were eight variates to be considered. These were the four levels of mental activity according to the Taxonomy for both the experimental group and the control group. No significant differences were found between the performances of the two groups when the nurses' subtotal scores on the posttest were analyzed separately. None of the F Ratios of the total and

TABLE 3

THE UNIVARIATE MAIN EFFECTS OF THE TOTAL AND SUBTOTAL SCORES OF  
NINETY-SIX NURSES ON THE POSTTEST AND THEIR SIGNIFICANCE  
AFTER ADJUSTMENTS FOR THREE COVARIATES

Variable	Main Effect	Ratio	$\frac{d.f.^a}{n \ d^b}$	Significance	Variates	Covariates
Total	0.13	0.10	1 91	n.s. <sup>c</sup>	2	3
Knowledge	0.72	1.21	1 91	n.s.	8	3
Comprehension	0.31	0.98	1 91	n.s.	8	3
Application	0.14	0.17	1 91	n.s.	8	3
Analysis	0.32	1.10	1 91	n.s.	8	3

Note:

a: d.f. = degrees of freedom

b: n = numerator; d = demoninator

c: n.s. = not significant at the .05 level of significance

subtotal univariate main effects, as shown in Table 3, were statistically significant.

Table 4 showed the univariate main effects of the scores of the ninety-six nurses who participated in the experiment. These were on clusters of test items which measured each of the seven educational objectives in the post-test, after adjusting the scores for the three covariates of the nurses' age, the study time, and the performance on the pretest. The covariate, years of nursing experience, was analyzed separately, later in the study.

The fourteen variates represented the seven educational objectives within the two groups. None of the F Ratios of the univariate main effects were statistically significant.

#### The Error Correlation Matrix

A correlation matrix was conducted between the four variables. These were:

1. The ages of the nurses
2. The study time of the nurses
3. The nurses' performance on the pretest
4. The nurses' performance on the posttest.

Table 5 showed a high, positive correlation between the ages of the nurses enrolled in the Pharmacology Program and the scores on both the pretest and the posttest. This suggested that age does affect the achievement of nurses as far as their ability to perform well on tests. This was significant at the .05 level of significance.

TABLE 4

THE UNIVARIATE MAIN EFFECTS OF THE SCORES OF NINETY-SIX  
NURSES ON ITEMS MEASURING SEVEN OBJECTIVES AND  
THE SIGNIFICANCE OF THESE EFFECTS AFTER  
ADJUSTMENTS FOR THREE COVARIATES

Variable	Main Effect	F Ratio	$\frac{d.f.}{n \ d} \begin{smallmatrix} a \\ b \end{smallmatrix}$	Significance	Variates	Covariates
Knowledge of Facts	-0.82	2.84	1 91	n.s. <sup>c</sup>	14	3
Knowledge of Trends	0.16	0.14	1 91	n.s.	14	3
Translation	0.10	0.10	1 91	n.s.	14	3
Interpretation	0.30	1.77	1 91	n.s.	14	3
Application	0.14	0.17	1 91	n.s.	14	3
Analysis of Elements	0.34	1.70	1 91	n.s.	14	3
Analysis of Relations	-0.11	0.10	1 91	n.s.	14	3

Note:

a: d.f. = degrees of freedom

b: n = numerator; d = denominator

c: n.s. = not significant at the .05 level of significance

The correlation of .30 between study time and the posttest suggested a poor relationship between the two variables even though it was significant at the .05 level of significance. The negative correlation of  $-.06$  between study time and age was not significant.

Table 5 showed a high, positive correlation between the pretest and the posttest. This showed that nurses with high scores on the pretest tended to score high on the posttest. Nurses with low scores on the pretest tended to score low on the posttest. Such a high, significant correlation of .82 indicated that the nurses performed consistently during the Program. Talmage, Walberg and Nicholas stated that "In keeping with past research findings, the most significant predictor of reading achievement was the pretest reading scores."<sup>12</sup> Since the same test was used as a measure of initial performance and of achievement, the consistency of performance also showed evidence of the reliability of the test.

The Performance of Nurses on the Posttest,  
According to Age, After Adjustments  
for Two Covariates

Table 6 showed the scores on the posttest of 32 nurses aged 18 through 29 years of age; 20 nurses with ages 30 through

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<sup>12</sup>Harriet Talmage, Herbert J. Walberg and Samuel Nicholas, "An Evaluation Research Model for System-wide Textbook Selection," paper presented at the American Educational Research Association Conference, Division B, New York, 1977, p. 5.

TABLE 5

THE ERROR CORRELATION MATRIX OF THE TOTAL  
SCORES OF NINETY-SIX NURSES

Variable	Posttest	Age	Study Time
Age	.70 <sup>a</sup>		
Study Time	.30 <sup>a</sup>	-.06	
Pretest	.82 <sup>a</sup>	.80 <sup>a</sup>	-.08

Note:

a = significant at the .05 level of significance

45 years and 44 nurses with ages of 46 through 55 years of age. The scores were analyzed separately to find out the different effects which the simulated situations might have had on each group of nurses. Separate analysis prevented any interaction which might have resulted if the three age groups were combined.

In the experimental group there were 21 younger aged nurses while there were 11 in the control group. In the middle aged group there were 9 in the experimental group and 11 in the control group. The older age category contained 19 nurses in the experimental group and 25 in the control group. In each of these age categories, the performances of the nurses who had received the series of simulated situations were compared with those nurses who had not been given the treatment. The total and subtotal scores on the posttest were adjusted for two covariates - the time spent in studying as well as the scores on the pretest. Years of previous nursing experience were analyzed later in the investigation.

Table 6 showed the univariate main effects, the F Ratio, the degrees of freedom, and the significance of each effect on the total and subtotal scores of the posttest according to the first four levels of the Taxonomy. The first column of Table 6 showed there were no differences between the total performances of the experimental group and the control group in the younger age category. There were differences in the subtotal level with respect to comprehension and analysis, at

TABLE 6

THE UNIVARIATE MAIN EFFECTS OF THE TOTAL AND SUBTOTAL SCORES OF  
NURSES, ACCORDING TO AGE, AND THE SIGNIFICANCE OF THESE  
EFFECTS AFTER ADJUSTMENTS FOR TWO COVARIATES

Variable	Younger Age N = 32 (Age 18-29 years)				Middle Age N = 20 (Age 30-45 years)				Older Age N = 44 (Age 46-55 years)				Var- iates	Covar- iates
	Main Effect	F Ratio	d.f. n d <sup>a</sup>	Sig <sup>b</sup>	Main Effect	F Ratio	d.f. n d <sup>a</sup>	Sig <sup>b</sup>	Main Effect	F Ratio	d.f. n d <sup>a</sup>	Sig <sup>b</sup>		
Total	2.32	3.48	1 28	n.s. <sup>c</sup>	-1.30	1.26	1 16	n.s. <sup>c</sup>	-1.58	1.01	1 40	n.s. <sup>c</sup>	2	2
Knowledge	0.11	0.06	1 28	n.s.	-1.01	1.40	1 16	n.s.	-1.16	1.42	1 40	n.s.	8	2
Application	0.02	0.14	1 28	n.s.	0.48	4.50	1 16	0.5	-0.14	0.14	1 40	n.s.	8	2
Comprehension	0.92	6.79	1 28	.05	0.35	0.25	1 16	n.s.	0.10	0.25	1 40	n.s.	8	2
Analysis	2.42	6.85	1 28	.05	0.38	0.39	1 16	n.s.	-0.39	0.58	1 40	n.s.	8	2

Note:

a: d.f. = degrees of freedom; n = numerator; d = denominator

b: sig = significance

c: n.s. = not significant at the .05 level of significance



the .05 level of significance. This superiority was established because the F Ratio and the Chi Square, as shown in Tables' 8 and 9 were significant.

The second column of Table 6 showed the differences between the total scores of the middle age group were not significant. The subtotal scores were also not significant except for the category of application at the .05 level of significance. This significance was not established because the F Ratio and the Chi Square, as shown in Tables 8 and 9, were not statistically significant.

The third column of Table 6 showed the differences between the performances of both the experimental group and the control group in the older age category. There were no significant differences between the groups for the total and subtotal scores.

#### The Main Effects of Age On Clusters of Test Items

Table 7 showed the univariate main effects, the F Ratio the degrees of freedom, and the significance of each effect on the scores of varying ages in all groups. These scores were on clusters of test items in the posttest measuring the seven educational objectives, after adjustments were made for study time and pretest performance.

The performance of the younger age nurses, as shown in the first column of Table 7, seemed to be superior to that of the nurses in both the middle age and the older age category.

TABLE 7

THE UNIVARIATE MAIN EFFECTS OF THE SCORES OF NURSES, ACCORDING TO  
AGE, ON ITEMS IN THE POSTTEST AND THEIR SIGNIFICANCE  
AFTER ADJUSTMENTS FOR TWO COVARIATES

	Younger Age N = 32 Age 18-29 years)				Middle Age N = 20 (Age 30-45 years)				Older Age N = 44 (Age 46-55 years)				Var- iates	Covar- iates
	Main Effect	F Ratio	<sup>a</sup> d.f. n d	<sup>b</sup> Sig	Main Effect	F Ratio	<sup>a</sup> d.f. n d	<sup>b</sup> Sig	Main Effect	F Ratio	<sup>a</sup> d.f. n d	<sup>b</sup> Sig		
Knowledge of Facts	-0.58	0.55	1 28	n.s. <sup>c</sup>	-0.42	0.27	1 16	n.s. <sup>c</sup>	-1.45	4.57	1 40	.05	14	2
Knowledge of Trends	0.32	1.05	1 28	n.s.	-0.43	0.51	1 16	n.s.	1.15	1.11	1 40	n.s. <sup>c</sup>	14	2
Translation	0.17	0.93	1 28	n.s.	-0.42	1.38	1 16	n.s.	-0.16	0.41	1 40	n.s.	14	2
Interpretation	0.58	6.07	1 28	.05	0.52	2.18	1 16	n.s.	0.10	0.09	1 40	n.s.	14	2
Application	0.02	0.14	1 28	n.s.	-0.48	4.50	1 16	.05	0.10	0.25	1 40	n.s.	14	2
Analysis of Elements	1.42	8.72	1 28	.01	1.27	9.85	1 16	.01	-0.72	1.57	1 40	n.s.	14	2
Analysis of Relations	-0.19	0.17	1 28	n.s.	0.13	0.10	1 16	n.s.	0.10	0.10	1 40	n.s.	14	2

Note:

a: d.f. = degrees of freedom; n = numerator; d = denominator

b: Sig = significance

c: n.s. = not significant at the .05 level of significance

The experimental group of younger aged nurses performed significantly superior to those in the control group. This was in respect to the cluster of test items measuring interpretation at the .05 level of significance, and to analysis of elements at the .01 level of significance. This superiority was not established because the F Ratio and the Chi Square, as shown in Tables 8 and 9, were not statistically significant.

The performances of the middle age category in the experimental group seemed superior to the control group in application at the .05 level of significance and to analysis of elements at the .01 level of significance. These significances were not established because of the aforementioned reason.

The performances of the older nurses in the experimental group seemed to be superior to those of the same age in the control group in respect to knowledge of facts. Tables 8 and 9 showed that the F Ratio and the Chi Square did not support this.

The Performance of Nurses on the Posttest,  
According to Previous Experience, After  
Adjustments for Three Covariates

The nurses who participated in the experiment were divided into three groups according to the number of years of nursing experience. Tomlinson found that many licensed practical nurses were given more opportunities to work in problem-solving situations after the nurses had worked

TABLE 8

THE VALUES AND SIGNIFICANCE OF THE F RATIO OF THE  
MAIN EFFECTS OF SCORES OF NURSES, ACCORDING TO AGE,  
AFTER ADJUSTMENTS FOR TWO COVARIATES

	F Ratio	d.f. <sup>a</sup> n d	Sig <sup>b</sup>	F Ratio	d.f. <sup>a</sup> n d	Sig <sup>b</sup>	F Ratio	d.f. <sup>a</sup> n d	Sig <sup>b</sup>	Var- iates	Covar- iates
	Younger Age N = 32 (Age 18-29 years)			Middle Age N = 20 (Age 30-45 years)			Older Age N = 44 (Age 46-55 years)				
Subtotals	3.44	2 21	.05	2.22	8.9	n.s. <sup>c</sup>	2.15	8.33	n.s. <sup>c</sup>	8	2
Clusters	2.55	14 14	n.s. <sup>c</sup>	2.64	14 3	n.s. <sup>c</sup>	1.55	14 27	n.s. <sup>c</sup>	11	2

Note:

a: d.f. = degrees of freedom; n - numerator; d = denominator

b: Sig = significance

c: n.s. = not significant at the .05 level of significance.

TABLE 9

THE VALUES AND SIGNIFICANCE OF THE CHI SQUARE OF THE  
MAIN EFFECTS OF SCORES OF NURSES, ACCORDING TO AGE,  
AFTER ADJUSTMENTS FOR TWO COVARIATES

	Chi Square	d.f. <sup>a</sup>	Sig <sup>b</sup>	Chi Square	d.f. <sup>a</sup>	Sig <sup>b</sup>	Chi Square	d.f. <sup>a</sup>	Sig <sup>b</sup>	Var- iates	Covar- iates
	Younger Age N = 32 (Age 18-29 years)			Middle Age N = 20 (Age 30-45 years)			Older Age N = 44 (Age 46-55 years)				
Subtotals	16.94	8	.05	9.12	8	n.s. <sup>c</sup>	9.15	8	n.s. <sup>c</sup>	8	2
Clusters	18.96	14	n.s. <sup>c</sup>	20.01	14	n.s.	18.42	14	n.s.	14	2

## Note:

a: d.f. = degrees of freedom

b: Sig = significance

c: n.s. = not significant at the .05 level of significance

consistently over a period of time. Such nurses were expected to make nursing decisions as to the care of patients without benefit of registered nurses on the units.<sup>13</sup>

Therefore, it was felt that the number of years involved in nursing would affect the practical nurse's ability to solve problems while administering medications. The nurses were divided into three groups. The first group had under one year of nursing experience. This group was designated as nurses with a limited amount of previous nursing experience. The second group's nursing experience was from one year through five years. These nurses were designated as those with a medium amount of previous nursing experience. The third group had six or more years of previous nursing experience and were designated as the high experienced group. The scores of the three groups were analyzed separately to avoid interaction between the performances.

There were 31 limited experienced nurses in the experiment, fourteen of which were in the experimental group and 17 in the control group. The nurses with the medium amount of previous experience totaled 31 nurses. The experimental group contained 13 while there were 18 in the control group. Thirty-four highly experienced nurses participated in the experiment, of which 19 were in the experimental group and 15 were in the control group.

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<sup>13</sup>Tomlinson, pp. 42-52.

TABLE 10

THE UNIVARIATE MAIN EFFECTS OF THE TOTAL AND SUBTOTAL SCORES OF NURSES,  
ACCORDING TO EXPERIENCE, AND THE SIGNIFICANCE OF THESE  
EFFECTS AFTER ADJUSTMENTS FOR THREE COVARIATES

Variable	Limited Experience N = 31 (Years - Under one year)				Medium Experience N = 31 (Years 1-5)				High Experience N = 34 (Years 6-12+)				Var- iates	Covar- iates			
	Main Effect	F Ratio	<sup>a</sup> d.f.		Main Effect	F Ratio	<sup>a</sup> d.f.		Main Effect	F Ratio	<sup>a</sup> d.f.						
			n	d			Sig <sup>b</sup>	n			d	Sig <sup>b</sup>			n	d	Sig <sup>b</sup>
Total	-1.72	0.54	1	26	n.s. <sup>c</sup>	0.28	0.04	1	26	n.s. <sup>c</sup>	2.16	2.79	1	29	n.s. <sup>c</sup>	2	3
Knowledge	-0.38	0.18	1	26	n.s.	0.42	0.04	1	26	n.s.	-0.92	1.01	1	29	n.s.	8	3
Comprehension	-0.48	0.74	1	26	n.s.	-0.46	0.39	1	26	n.s.	1.02	9.03	1	29	.01	8	3
Application	-0.13	0.12	1	26	n.s.	-0.17	0.28	1	26	n.s.	0.12	0.03	1	29	n.s.	8	3
Analysis	-0.78	0.88	1	26	n.s.	0.38	0.18	1	26	n.s.	2.22	10.01	1	29	.01	8	3

Note:

a: d.f. = degrees of freedom; n = numerator; d = denominator

b: Sig = significance

c: n.s. = not significant at the .05 level of significance

TABLE 11

THE UNIVARIATE MAIN EFFECTS OF THE SCORES OF NURSES, ACCORDING TO EXPERIENCE,  
ON ITEMS IN THE POSTTEST AND THEIR SIGNIFICANCE AFTER  
ADJUSTMENTS FOR THREE COVARIATES

Variable	Limited Experience N = 31 (Years - Under one year)				Medium Experience N = 31 (Years 1-5)				High Experience N = 34 (Years 6-12+)				Var- iates	Covar- iates
	Main Effect	F Ratio	$\frac{d.f.^a}{n \ d}$	Sig <sup>b</sup>	Main Effect	F Ratio	$\frac{d.f.^a}{n \ d}$	Sig <sup>b</sup>	Main Effect	F Ratio	$\frac{d.f.^a}{n \ d}$	Sig <sup>b</sup>		
Knowledge of Facts	-0.00	0.58	1 26	n.s. <sup>c</sup>	0.16	0.12	1 26	n.s. <sup>c</sup>	0.72	1.50	1 29	n.s. <sup>c</sup>	14	3
Knowledge of Trends	0.29	0.36	1 26	n.s.	0.42	0.92	1 26	n.s.	0.15	0.12	1 29	n.s.	14	3
Translation	0.11	0.10	1 26	n.s.	0.38	0.72	1 26	n.s.	0.17	1.54	1 29	n.s.	14	3
Interpretation	-0.48	0.99	1 26	n.s.	-0.19	0.99	1 26	n.s.	0.82	6.51	1 29	.05	14	3
Application	-0.14	0.12	1 26	n.s.	-0.26	0.36	1 26	n.s.	0.12	0.12	1 29	n.s.	14	3
Analysis of Elements	-0.65	0.65	1 26	n.s.	0.38	0.24	1 26	n.s.	1.74	9.95	1 29	.01	14	3
Analysis of Relations	-0.25	0.27	1 26	n.s.	0.21	0.20	1 26	n.s.	0.44	1.23	1 29	n.s.	14	3

Note:

a: d.f. = degrees of freedom; n = numerator; d = denominator

b: Sig = significance

c: n.s. = not significant at the .05 level of significance



The scores of these nurses were adjusted by three covariates. These were the nurses' ages, the amount of study time and the scores on the pretest. Tables 10 and 11 showed the univariate main effects of the scores of the nurses. The total and subtotal scores were shown in Table 10 with the F Ratio, the degrees of freedom and the significance of each. Table 11 showed these scores analyzed on clusters of test items measuring the seven educational objectives according to Taxonomy.

The first and second columns of Table 10 showed the F Ratios of the main effects of the total and subtotal scores of those nurses with limited and medium nursing experience. These ratios were not significant. The performances of both the experimental group and the control group with limited and medium previous nursing experience were approximately equal.

The third column of Table 10 showed that there was no significant difference between the total performance, on the posttest, of the experimental group and the control group with high previous experience. There were significant differences between the two groups with respect to comprehension and analysis at the .01 level of significance.

When the scores of the high experienced group on clusters of test items were analyzed separately, significant differences appeared between the experimental group and the control group. Table 11 showed that items were significant at the .05 level of significance when interpretation was measured, and at the .01

level of significance when analysis of elements was measured.

These significant differences were established because the F Ratio, as shown in Table 12, and the Chi Square, as shown in Table 13, were both statistically significant.

Finally, correlation coefficients were computed on the total and subtotal scores for the ninety-six nurses. Post-test scores were adjusted for the pretest scores and the coefficients were computed for each pair of observations. Table 14 depicted the results on the three correlations. These were: (1) the overall correlations between the pretest and the posttest; (2) the correlation between the treatment level means for the pretest and the posttest, and (3) the weighted average correlation between the pretest and the posttest.

The overall correlations were high and positive which indicated that the performances of the ninety-six nurses were consistent. The correlation between the groups indicated that both groups did approximately the same on both the pretest and the posttest. Therefore, this depicted that both groups were drawn from the same population whose variances were equal. The correlations within the groups indicated that the scores of the nurses within the groups reflected the dispersion of the scores.

According to Kirk, if the between groups correlations were larger than those of the within groups "the reduction in the variation attributable to the treatment can be large

TABLE 12  
THE VALUES AND SIGNIFICANCE OF THE F RATIO OF THE  
MAIN EFFECTS OF SCORES OF HIGH EXPERIENCED NURSES  
AFTER ADJUSTMENTS FOR THREE COVARIATES

	Ratio	$\frac{d.f.^a}{n \ d}$		Significance	Var- iates	Covar- iates
High experience N = 34 (Years 6-12+)						
Subtotals	4.10	8	22	.05	8	3
Clusters	4.42	14	16	.01	14	3

Note:

a: d.f. = degrees of freedom; n = numerator;  
d = denominator

TABLE 13

THE VALUES AND SIGNIFICANCE OF CHI SQUARE OF THE  
MAIN EFFECTS OF SCORES OF HIGH EXPERIENCED NURSES  
AFTER ADJUSTMENTS FOR THREE COVARIATES

	Chi Square	d.f. <sup>a</sup>	Significance	Var- iates	Covar- iates
High experience    N = 34    (Years 6-12+)					
Subtotals	21.41	8	.05	8	3
Clusters	32.86	14	.01	14	3

Note:

a: d.f. = degrees of freedom; n = numerator;  
d = denominator

TABLE 14

CORRELATION COEFFICIENTS OF THE TOTAL AND SUBTOTAL SCORES OF  
NINETY-SIX NURSES ON THE POSTTEST FOR BETWEEN,  
WITHIN, AND TOTAL SUMS OF SQUARES

Variables	$r_T^a$	$r_B^b$	$r_W^c$
Total	.84	.57	.34
Knowledge	.72	.49	.42
Comprehension	.80	.52	.35
Application	.83	.67	.37
Analysis	.79	.64	.59

Note:

- a:  $r_T$  = overall correlation between pretest and post-test scores
- b:  $r_B$  = correlation between treatment level means
- c:  $r_W$  = weighted average correlation between pretest and posttest for the treatment levels

relative to the reduction in the error variation."<sup>14</sup> In this investigation the between group variation was slightly larger than that of the within groups, therefore the results showed that there was experimental error in the study.

### Conclusion

In this chapter, the results of the experiment of a Pharmacology and Medication Administration Program were reported and discussed. The results were from the analysis of 96 practical nurses who formed the total sample. As many as 32 of these nurses were of the ages 18 through 29 years. The mean age was 22 years. There were 20 nurses of the ages 30 through 45 years, with a mean age of 38 years. In the older age group there were 44 nurses between the ages of 46 through 55 years of age. This age group had a mean age of 48 years.

As many as 31 of these nurses had limited previous nursing experience of under one year. The mean for this group was three months. There were 31 nurses who had a medium amount of nursing experience of 1 year through 5 years. The mean for this group was 3 years of experience. Thirty-four nurses had a high number of years of previous nursing experience of 6 and over years, with a mean of 8 years of experience.

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<sup>14</sup>Kirk, p. 468.

Analysis of Covariance was used to analyze the scores of the practical nurses on the posttest. Ages, study time, and performance on the pretest were used as covariates.

Although the total performance of the experimental group on the posttest exceeded those of the control group, the differences between the performances of the two groups were not statistically significant. The correlations of the pretest and the posttest, based on the total scores of the ninety-six nurses in this experiment, was .87 for the posttest. This correlation was fairly high so that it may be said that the test was reliable to measure the educational objectives according to the Taxonomy.

When subtotal scores were studied the experimental group's performance in the younger age category exceeded the performance of the control group. This was with respect to comprehension and analysis. This superiority was established because the F Ratio and the Chi Square were significant at the .05 level of significance.

When the scores were analyzed with regard to clusters of test items corresponding to the Taxonomy, the experimental group appeared to be superior to those in the control group of the younger age category in the areas of interpretation and analysis of elements.

The experimental group appeared to be superior to the control group of the middle age category in the area of application at the .05 level of significance and analysis of

elements at the .01 level of significance. In the older age category the experimental group appeared to be superior to the control group in the area of knowledge of facts at the .05 level of significance and analysis of elements at the .01 level of significance. In the older age category the experimental group appeared to be superior to the control group in the area of knowledge of facts at the .05 level of significance. These differences could not be established because the F Ratio and the Chi Square were not significant.

The scores of the practical nurses were analyzed with respect to the amount of previous nursing experience. Those nurses who had under one year of nursing experience were considered to have limited previous nursing experience. In studying the scores of the experimental group and the control group in regard to this category, there were no significant differences in performance.

Nurses who had from one year through five years of previous nursing experience were designated as those nurses with a medium amount of experience. The performance of both the experimental group and the control group were approximately equal.

Nurses who had worked from six years and over were considered to have a high amount of nursing experience. There were significant differences between the experimental group and the control group in the categories of comprehension, analysis, and analysis of elements. These differences were

significant at the .01 level of significance. Differences were found with interpretation at the .05 level of significance. In all these categories the experimental group was superior to the control group. The F Ratio and the Chi Square established this fact at the .05 level of significance for the subtotal scores and the .01 level of significance for the clusters of test items.



## CHAPTER V

### CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

This chapter presented conclusions concerning the five hypotheses and the implications of the findings of this study for further research. , In the first section of the chapter, the findings concerning each hypothesis were discussed separately. The second part of the chapter dealt with implications of the study for further research.

#### Conclusions Concerning the Hypotheses

Hypothesis 1: There will be no difference in the problem-solving scores on a posttest for practical nurses who receive simulated patient situations and for practical nurses who receive traditional methods.

This hypothesis dealt with the effectiveness of simulated patient situations and traditional methods of teaching to help students solve problems. Although the overall performance of the experimental group appeared to exceed that of the control group, this could not be proved statistically. Therefore, this hypothesis had to be accepted as there was no significant difference in the over-all problem-solving scores on a posttest between the experimental group and the control group.

Hypothesis 2: There will be no difference in problem-solving scores for practical nurses who receive simulated patient situations and practical nurses who receive traditional methods of teaching by amount of time spent in studying.

This hypothesis dealt with the efficiency of simulated patient situations and traditional methods of teaching. The nurses who received the simulated patient situations spent less time in study than those nurses who studied according to the traditional method of merely reading the required textbook. According to the times recorded by the practical nurses on Instrument II, the Daily Study Time Record, the mean difference in time between the experimental group and the control group was 11 minutes and 18 seconds for the 96 nurses. According to age, the mean difference in study time was 5 minutes and 2 seconds for the younger nurses; the middle age nurses spent 10 minutes and 20 seconds difference in study time the older nurses had 17 minutes and 33 seconds difference in study time.

The amount of study time between the experimental group and the control group according to previous nursing experience was compared. The mean difference in study time for those nurses with a limited number of years of experience was 19 minutes and 49 seconds; the medium experienced nurses spent 25 minutes and 39 seconds while the high experienced nurses spent 11 minutes and 47 seconds difference in study time.

In two of the three groups the scores were significant. Those of the younger nurses and those with a high amount of previous nursing experience. Therefore, in these two cases the simulated patient situations were most efficient as far as study time was concerned and the hypothesis had to be rejected. For all other nurses, the simulated patient situations were equal to the traditional method of study time so that this hypothesis had to be accepted that there was no difference in the problem-solving scores by amount of time spent in studying.

Hypothesis 3A: There will be no difference in the problem-solving scores for practical nurses who receive simulated patient situations and practical nurses who receive traditional methods of teaching according to age.

When the scores were analyzed according to different ages, it appeared that the performance of the experimental group exceeded that of the control group. The younger age group achieved higher scores on the sublevel categories of comprehension and analysis. On clusters of test items younger aged nurses performed better in interpretation and in analysis of elements. Therefore, this hypothesis had to be rejected as far as the younger aged nurses were concerned, as there was a difference in problem-solving scores according to age. However, there was no significant difference in the performance of the middle age group or the older practical nurses. This

hypothesis would have to be accepted for these two groups.

Hypothesis 3B: There will be no difference in the problem-solving scores for practical nurses who receive simulated patient situations and practical nurses who receive traditional methods of teaching according to years of previous nursing experience.

This hypothesis had to be totally accepted for those nurses who had limited or medium amount of previous nursing experience. Even though the scores of the experimental group exceeded those of the control group, the results were not statistically significant. However, those nurses in the experimental group who had a high amount of previous nursing experience performed better than those with comparable years of experience in the control group. The result was statistically significant for comprehension and analysis at the subtotal levels. On clusters of test items the high experienced nurses performed significantly better for interpretation at the .05 level of significance and for analysis of elements at the .01 level of significance. Therefore, this hypothesis was rejected for this group of nurses as previous nursing experience did make a difference in the problem-solving scores.

Hypothesis 4: There will be no difference in the development of lower as well as higher mental processes for practical nurses who receive simulated patient situations

and for practical nurses who receive traditional methods of teaching.

For the purpose of this investigation, the level of knowledge in the Taxonomy of Educational Objectives: Handbook I: The Cognitive Domain<sup>1</sup> was designated as a lower mental process. The two sublevels, knowledge of facts and knowledge of trends, also represented lower mental processes. However, knowledge of trends was considered to be one step higher than that of facts. Similarly, the level of analysis was designated as a higher mental process, and the two sublevels, analysis of elements and analysis of relationships, represented higher mental processes. In the Taxonomy, there was a hierarchy in which analysis of relationships was considered to be a step higher than that of analysis of elements.

The hypothesis had to be rejected because the performance of the nurses who studied the simulated patient situations on test items measuring lower and higher mental processes, were in all cases either equivalent or significantly superior to those nurses who had studied according to the traditional methods. Nurses who were of the middle or older age category, or those with limited or medium amount of

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<sup>1</sup>Bloom et al., 1956.

previous nursing experience achieved approximately equal scores on all levels on the posttest. The younger aged nurses and those with a high amount of previous nursing experience in the experimental group did significantly better at the .05 level of significance than those nurses in the control group with comparable age and nursing experience.

### Interpretation of Findings

Several factors may have accounted for the lack of significant differences between the experimental group and the control group with regard to the hypotheses tested in this investigation.

The simulated patient situations may be less effective than the traditional methods of teaching. Up to the present time, written simulations have been used to measure problem-solving only and have not been utilized as a teaching strategy. Instrument I, as a written simulated patient situation, was significantly more effective and efficient than the traditional method of teaching with respect to some educational objectives, and with nurses who were younger or who had a high amount of previous nursing experience. This was depicted in Tables 8, 9, 12 and 13 which showed both the F Ratio and the Chi Square were significant at the .05 level of significance.

The simulated patient situations may have had a contrary effect on some nurses because the concept of self-teaching materials was new. Pensivy states that "A current new approach to nursing education is that of individualized

instruction. . . .as a means of involving the student in a more active learning experience."<sup>2</sup> Nurses in the middle and older' age groups or those with a limited or medium amount of previous nursing experience may not have been acquainted with any type of programmed materials. Because the materials were new the nurses might have spent time adjusting to the method, and some may have not completed the situations. The Daily Time Record, Instrument II, asked the practical nurses to record the amount of study time, not the quality or quantity. Such nurses need more time and effort to discover new approaches to learning before participating in an investigation.

Hiemstra examined older adults' preferences for instrumental versus expressive learning activities. In his study of 256 participants over the age of 68 years of age, he found that there was a significant increase in performance when the subjects were given instrumental activities rather than expressive activities. The participants were blue collar workers with a mean number of years of school through eighth grade.<sup>3</sup> In order to enter the practical nurse program, which is only one year's duration, a high school diploma is not required. Practical nurses may prefer to learn technical skills rather than expressing concepts as depicted in the

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<sup>2</sup>Barbara A. Pensivy, "Traditional Versus Individualized Nursing Instruction," Journal of Nursing Education 16 (February, 1977): 14.

<sup>3</sup>Roger Hiemstra, "Older Adult Learning: Instrumental and Expressive Categories," Educational Gerontology 13 (September, 1976):227-36.

written simulated patient situations.

If written simulated patient situations were difficult for the practical nurses to conceptualize, problem-solving ability may have been learned if the simulations were given by videotape. Blaiwes and Weller state that "Two key features of a simulator are that it provides stimuli and requires responses that resemble critical features of the . . . situation."<sup>4</sup> A problem situation would be presented by videotape and the practical nurse would need to resolve the problem by collecting information and taking action after seeing the situation. One aspect of computerized situations would be that the practical nurse would receive immediate feedback of the results of the action taken.

Instrument I was written as a constructed-response, linear type of self-teaching instruction. This type of simulated situation caused the student to receive immediate feedback before continuing into the next aspect of the situation. Mutzebaugh and Dunn state that "The more often a response is followed by a positive reinforcement, the greater is the probability of its being reproduced under the same circumstances. There is a cumulative effect of positive reinforcement."<sup>5</sup> In written simulated patient situations the

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<sup>4</sup>Blaiwes and Weller, p. 18.

<sup>5</sup>Carole Mutzebaugh and Jeannette Dunn, "The Teacher as a 'Reinforcement Machine' in the teaching-learning process," *Journal of Nursing Education* 15 (September, 1976): 31.



practical nurse received feedback but not reinforcement. Mutzebaugh and Dunn state that "feedback, as the knowledge of the adequacy of the performance, is different from reinforcement in that the student must be aware of the correctness of his response."<sup>6</sup> In written simulated situations the nurse was not aware of the correct action taken until the end of the situation and the "patient" was discharged or had complications.

O'Neill, Rasor and Bartz were interested in the type of feedback most effective in short-term retention. There were 52 males and 64 females with the median ages of 25.3 and 22.4 respectively. A fifty item ability test was administered and the subjects were divided into four groups with different types of feedback. The results showed that all types of feedback "facilitate retention of correct answers on a test while a lack of feedback results in no change when retested. . . . for best immediate retention...feedback could be given by handing students a key showing all correct answers when they have completed the test."<sup>7</sup>

Another factor which might have affected the performance of the practical nurses was that such programmed material may be more effective in some fields of subject matter than in

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<sup>6</sup>Ibid., p. 32.

<sup>7</sup>O'Neill, Rasor, and Bartz, p. 74.

others. This kind of teaching tool may prove to be effective in disciplines such as mathematics or statistics instead of pharmacology or nursing. Other disciplines, such as medicine and dentistry, have undertaken to measure problem-solving by testing the student's ability to manage problematic patients. Medication administration was similar to such subject matter in these health fields.

The written simulated patient situations used in this study may not have been representative of well written simulations. After studying many examples of written simulations, the investigator attended a workshop under the auspices of the University of Illinois at the Medical Center, Chicago, to learn the techniques of writing simulations. The written were checked by the five judges who were experts in the fields of pharmacology and nursing. As each item was independently rated, the item was either rewritten or discarded if there was not a consensus of opinion. Four practical nurses also noted if there were any discrepancies of wording.

Other factors that may have contributed to the lack of significant differences in the findings may have had to do with Instrument III. Used as a measuring instrument it may not have been powerful enough to measure the effects of the simulated patient situations. This study presented evidence concerning the reliability of Instrument III as an examination. The correlations between the pretest and the posttest, based on the performance of the ninety-six nurses presented evidence of the reliability of the instrument.

As far as the validity of Instrument III, each test item had been specifically written against the content of the Pharmacology Program. This was affirmed by the five judges. The item discrimination and difficulty index discarded those items which might have had a deleterious effect on the nurses' response. Those items were discarded both in the pre-test and the posttest. The construct validity was affirmed by a factor analysis. Beside the four levels of the Taxonomy the factor analysis specifically discriminated sublevels of test items.

The use of more than one form of Instrument III was necessary. The same examination was administered to measure the initial performance of the nurses and the achievement after the Program was completed. Giving the same test twice may have been a teaching experience for all the nurses whether in the experimental group or the control group. The only way to minimize this problem was to use two equivalent forms of the same examination.

Another factor that may have contributed to the lack of significant differences in the study was that the students were not randomized. Intact classrooms were utilized, one as the experimental group and the other as the control group. Campbell and Stanley state that "If either of the comparison groups has been selected for its extreme scores ... then a difference in degree of shift from pretest to posttest between the two groups may well be a product of regression rather than

the effect of [the treatment.]"<sup>8</sup> Analysis of Covariance was suggested as a statistical technique to remove the differences that may have caused the regression. The use of intact classrooms resulted in larger sample sizes. When the sample size is large, the power of the test is increased.<sup>9</sup>

Another problem associated with utilization of intact classrooms was that different teachers might have affected the learning of the practical nurses. Van Dalen states that "the success of the experiment rested on one important assumption: that the experimental and the control groups be equivalent in respect to all factors that may influence the dependent variable except for the exposure to [the treatment.]"<sup>10</sup> In the present study, each intact group received lectures from specific outlines as taught by a team of pharmacists and nurses. The traditional method of expository teaching was maintained in both the experimental classroom and the control classroom as a different speaker presented the individual lecture.

Analysis of Covariance was used to remove differences from the groups. Traditional differences of age, amount of study time, years of previous experience and pretest scores were considered factors which might have affected the scores of the nurses. There may have been other variables which

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<sup>8</sup>Campbell and Stanley, p. 49.

<sup>9</sup>Kirk, p. 10.

<sup>10</sup>Van Dalen, p. 274.

influenced the performance of both the experimental group and the control group, and that were not accounted for in the study'. In the study conducted by Talmage, Walberg and Nicholas a step-wise multiple regression analysis was conducted and analyzed. After entering the pretest reading scores in all the step-wise regression analyses to remove effects on the posttest reading scores, the investigators stated that "Following examination of all main effects, interaction effects were explored to study possible advantages of one series over others given various teaching and instructional characteristics and under various environments."<sup>11</sup> The results indicated that after removing pretest effects, one other variable, that of competitiveness in the learning situation, accounted for significant differences. Teacher differences did not account significantly for the remaining variance.<sup>12</sup>

#### Implications for Further Research

This study has several implications for further research concerning written simulated patient situations. Replications of this study in other practical nurse settings is recommended. Very few studies of this kind have been conducted, using practical nurses as subjects, or simulations as a teaching strategy. Verification of the result of this study is needed

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<sup>11</sup>Talmage, Walberg and Nicholas, p. 3.

<sup>12</sup>Ibid., p. 5.

to find out whether the conclusions are similar with the larger population of practical nurses and to different types of nursing programs.

It is recommended that the investigation be conducted in situations in which randomization is utilized and that two equivalent forms of the measuring instrument be used. Written simulated patient situations could be used as a teaching strategy or a measuring instrument if the validity and reliability could be established. The experiment should be carried out in nursing programs in which nurses represent various socio-economic backgrounds and where the effect of the teacher is accounted for in the results of the investigation.

The study presents evidence of the effectiveness and efficiency of written simulated situations and the traditional method of teaching. The lack of significant differences between the experimental group and the control group showed that written simulations were not significantly less effective and efficient. They were significantly more effective and efficient for some objectives, and with younger nurses or those who had a high amount of previous nursing experience. The simulations helped to develop lower and higher mental processes. The performance of the experimental group was equal to that of the control group in all levels of the Taxonomy when the subtotal categories were analyzed. The performance was significantly more effective in the areas of analysis and

analysis of elements which were considered to be higher levels of mental ability.

According to the Taxonomy, the sublevel analysis of relationships was one step higher than analysis of elements. The younger aged nurses or those nurses with a high number of years of previous nursing experience did not perform significantly better at this higher level than the nurses in the control group with a comparable age or years of experience. The lack of significance at this level showed that written simulated situations may not help nurses achieve higher mental processes such as synthesis and evaluation.

There is a need to explore the possibilities and limitations of written simulated patient situations to develop higher mental processes. The task ahead of the nurse-educator-researcher who intends to probe into incorporating simulated situations into the curriculum, must gather evidence in three ways. First, higher mental processes must be broken down into specific components; the components must be arranged in a gradual progression from the simple to the complex and the simulation should be designed according to this progression; a study must be conducted to provide evidence of the effectiveness and efficiency of the teaching strategy. For nurses, the degree of problem-solving ability is still an unknown.

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## APPENDIX A

## KARDEX

NAME John CollierROOM NUMBER 301

DATE	MEDICATIONS	DOSA GE	MODE TIME	TREATMENTS
10/16	U80 PZI Insulin	16units	SQ 7.30 a.m.	F.B.S. daily
10/16	Librium	5mg	po 9-1-5	Cliniftest-routine
10/16	Tetracycline Hcl	250mg	po 9-3-9-3	

DIAGNOSIS	Diabetes Mellitus; Pneumonia	AGE	42	SERVICE	Dr. G. Gerard
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## MEDICATION CARDS

NAME	JOHN COLLIER	JOHN COLLIER	JOHN COLLIER
ROOM	301 START 10/16	301 START 10/16	301 START 10/16
DRUG	U80 PZI Insulin	Librium	Tetracycline Hcl
DOSE	16 units SQ	5mg po	250mg po
TIME	7:30 a.m.	9-1-5	9-3-9-3

## KARDEX

NAME Kate O'BrienROOM NUMBER 302

DATE	MEDICATIONS	DOSAGE	MODE	TIME	TREATMENTS
10/20	Digitoxin	0.15	po	9am	Apical Pulse
10/20	Hydrodiuril	100mg	po	8am	Weight daily
10/20	Serpasil	0.5mg	po	9am	O/O q8h
10/21	Coumadin	5mg	po	10am	B.P. q4h

Prothrombin Time-6am

DIAGNOSIS CHF:MI; Hypertension AGE 75 SERVICE Dr. Cooper

## MEDICATION CARDS

NAME	KATE O'BRIEN	KATE O'BRIEN	KATE O'BRIEN	KATE O'BRIEN
ROOM	302 START 10/20	302 START 10/20	302 START 10/20	302 START 10/20
DRUG	Digitoxin	Hydrodiuril	Serpasil	Coumadin
DOSE	0.15mg po	100mg po	0.5mg po	5 mg po
TIME	9am	8am	9am	10am



## KARDEX

NAME Lena WolskyROOM NUMBER 303

DATE	MEDICATIONS	DOSAGE	MODE	TIME	TREATMENTS
10/21	Compazine Spansule	5mg	po	9-6	
10/21	Prednisone	10mg	popc	9-1-6	
10/21	Potassium Penicillin G	600,000 units	IM	9-3-9-3	
10/21	Aspirin q 4 h prn pain	600mg	po		

Abcess I/ D 10/20

DIAGNOSIS Rheumatoid Arthritis,AGE 62SERVICE Medical

## MEDICATION CARDS

NAME	LENA WOLSKY	LENA WOLSKY	LENA WOLSKY	LENA WOLSKY
ROOM	303 START 10/21	303 START 10/21	303 START 10/21	303 START 10/21
DRUG	Compazine Spansule	Prednisone	Potassium Penicillin G	Aspirin
DOSE	5mg po	10mg poac	600,000units IM	600mg po
TIME	9-6	9-1-6	q6h 9-3-9-3	q4h prn pain

## KARDEX

NAME James ZelkoROOM NUMBER 304

DATE	MEDICATIONS	DOSAGE	MODE	TIME	TREATMENTS
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OR today - 10am

DIAGNOSIS Abdominal painAGE 22Dr. L.  
SERVICE Santos

## KARDEX

NAME Sally JonesROOM NUMBER 305

DATE	MEDICATIONS	DOSAGE	MODE	TIME	TREATMENTS
11/2	Probanthine	15mg	poac & HS	8-14-4-9	Upper GI series TODAY-on call

DIAGNOSIS \_\_\_\_\_ AGE 46 SERVICE Dr. Cooper

## MEDICATION CARD

NAME SALLY JAMESROOM 305 START 11/2DRUG ProbanthineDOSE 15mg poac & HSTIME 8-12-4-9

## APPENDIX B

## WRITTEN SIMULATIONS

## PREPARATION OF MEDICATIONS - Part I

NAME \_\_\_\_\_

HOSPITAL \_\_\_\_\_

DATE \_\_\_\_\_

## INSTRUCTIONS

You have been given a written simulated patient situation which has been designed to assist you in problem-solving. The simulation is sectioned so that there are several possibilities of answering each section. You are to choose the answers according to how YOU would solve the problem in a real-life situation, working as a licensed practical nurse and administering medications. There is also some information that is not useful to the solution of the problem and may be misleading. Therefore, you must use your judgement when answering each section. Do not guess at the answer because there are several ways to solve each problem successfully.

You have been given an "invisible" marker. You are to rub the marker alongside each item in order to receive information. RUB GENTLY ONCE and wait 30 seconds, otherwise the response will not appear. To see how it works, gently rub the marker over the section between the horizontal lines:

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medication

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If done correctly the word MEDICATION should have appeared. After receiving an "invisible" response be careful to follow directions exactly as given. At the end of each section there are also directions. Follow these instructions carefully. If you do not you will find that the problem may become more complicated than is necessary.

Now turn the page and begin the first section.

## PREPARATIONS OF MEDICATIONS

You are a licensed practical nurse working days in a large metropolitan hospital. As a float nurse you have been assigned to give morning medications to a selected group of patients on a medical-surgical unit. After finishing report at 7:15 a.m. the head nurse hands you the medication cards and says "Here's the medication room key - it's all yours!"

## NOW CONTINUE WITH SECTION A

## SECTION A - DATA GATHERING

Your FIRST choice of action would be to (Choose ONLY ONE)

1. Get Kardex from nurse's desk
2. Ask where the medication room is located
3. Ask another LPN to help you prepare medications
4. Start preparing the medications beginning with your top card
5. Feel a headache coming on
6. Make a note of the patient assignment list for the day

UNLESS OTHERWISE DIRECTED CONTINUE WITH SECTION-B

## SECTION B

Now, you would be ESPECIALLY interested to check (Choose ONLY TWO)

7. Make a list of the patient assignments for the day unless already done so
8. Start preparing the medications beginning with your top card unless already done so
9. Sort cards according to the room numbers and patient's names

10. Ask where the medication room is located
11. Begin to prepare your 7:30 a.m. medication as it is almost 7:20 a.m.
12. Obtain the Kardex from the nurse's desk unless already done so

UNLESS DIRECTED OTHERWISE CONTINUE WITH SECTION C

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### SECTION C

You now have the medication cards for your patients. In order to compare them against the Kardex you would FIRST sort the cards according to (Choose ONLY TWO)

13. Times of administration
14. Medications as listed in the Kardex
15. Routes prescribed
16. Room numbers and patient's names

CONTINUE AS DIRECTED IN RESPONSES

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### SECTION D DATA GATHERING

Now turn to Appendix A. In comparing this patient's medication cards against the Kardex you would check each card as listed according to (Choose as many as are pertinent to this situation)



Card #1	Card #2	Card #3
17. Patient's room number and full name	31.	45.
18. Start and stop dates	32.	46.
19. Name of drug	33.	47.
20. Dosage	34.	48.
21. Route	35.	49.
22. Time	36.	50.
23. Diet	37.	51.
24. Allergies	38.	52.
25. Nurse's signature	39.	53.
26. Doctor's signature	40.	54.
27. Laboratory Tests	41.	55.
28. Urine Tests	42.	56.
29. Daily activities	43.	57.
30. Vital Signs	44.	58.

CONTINUE SECTION ON NEXT PAGE

#### SECTION D CONTINUED

In comparing your second patient's medication cards against the Kardex you would check each as listed according to (Choose as many as are pertinent to this situation)

	Card #1	Card #2	Card #3	Card #4
59. Patient's room number and full name	73.	87.	101.	
60. Start and stop dates	74.	88.	102.	
61. Name of drug	75.	89.	103.	
62. Dosage	76.	90.	104.	
63. Route	77.	91.	105.	
64. Time	78.	92.	106.	
65. Diet	79.	93.	107.	
66. Allergies	80.	94.	108.	
67. Nurse's signature	81.	95.	109.	
68. Doctor's signature	82.	96.	110.	
69. Laboratory Tests	83.	97.	111.	
70. Urine Tests	84.	98.	112.	
71. Daily Activities	85.	99.	113.	
72. Vital Signs	86.	100.	114.	

In comparing your third patient's medication cards against the Kardex you would check each card as listed according to (Choose as many as are pertinent to this situation)

	Card #1	Card #2	Card #3
115. Patient's room number and full name		129.	143.
116. Start date		130.	144.
117. Name of drug		131.	145.
118. Dosage		132.	146.
119. Route		133.	147.
120. Time		134.	148.
121. Diet		135.	149.
122. Allergies		136.	150.
123. Nurse's signa		137.	151.
124. Doctor's signature		138.	152.
125. Laboratory tests		139.	153.
126. Urine tests		140.	154.
127. Daily activities		141.	155.
129. Vital Signs		142.	

In comparing your next patient's medication cards against the Kardex you would check each card as listed according to (Choose as many as are pertinent to this situation)

156. Patient's room number and full name	164. Nurse's signature
157. Start and Stop dates	165. Doctor's signature
158. Name of drug	166. Laboratory Tests
159. Dosage	167. Urine Tests
160. Route	168. Daily Activities
161. Time	169. Vital Signs
162. Diet	170. Treatments
163. Allergies	

In view of the available information you would NOW (Choose ONLY ONE)

- 171. Enquire of the head nurse if there are any more medication cards
- 172. Ask where the medication room is located if you have not already done so
- 173. Check through the Kardex once more to make sure you have all the medication cards
- 174. Prepare your medications starting with your top card
- 175. Start looking up the medications with which you are not familiar

UNLESS OTHERWISE DIRECTED CONTINUE WITH SECTION F

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#### SECTION F MANAGEMENT

It is now 7:25 a.m. In preparing your FIRST medication you would be especially interested in selecting (Choose ONLY ONE)

- 176. Protomine Zinc Insulin
- 178. Semilante insulin
- 177. Lente Insulin
- 179. Regular Insulin

In view of this information you would NOW select (Choose ONLY ONE)

- 180. An U40 syringe with a 5/8", 25 gauge needle
- 181. An U80 syringe with a 1/2", 26 gauge needle
- 182. An U100 syringe with a 5/8", 25 gauge needle
- 183. A one cc syringe with a 1/2", 26 gauge needle
- 184. A three cc syringe with a 5/8", 25 gauge needle

You would NOW check (Choose as many as would be pertinent to THIS situation)

- 185. Number of units per cc on the vial
- 186. Expiration date

187. Color of the medication
188. Patient's room number and full name
189. List dose given to patient
190. Pharmaceutical Company.

With this information it is NOW important to (Select as many as are important to this situation)

191. Leave medication at room temperature
192. Wipe rubber stopper with an alcohol sponge
193. Wash hands
194. Shake vial carefully
195. Insert 16 units of air into vial
196. Rotate vial gently between hands
197. Draw up 80 units of insulin.

Unless directed otherwise develop response 198 OR 199

198. Draw up 16 units of insulin  
into your syringe
199. Draw up 16ml. of insulin  
into your syringe

You would NOW (Choose ONLY TWO)

200. Draw back 0.2ml air into  
your syringe
201. Draw back 2.0ml air into  
your syringe
202. Check label of medication  
with medication card
203. Check label of medication  
with doctor's order.

## CONTINUE WITH SECTION G

## SECTION G DATA GATHERING

As you take the medication, medication card and alcohol sponge on a tray into Room 301, your FIRST action would be to  
(Choose ONLY ONE)

- 204. Call the patient by name
- 205. Ask the patient his name
- 206. Look at the name band
- 207. Glance at the medication card
- 208. Check the bed number
- 209. Pour a glass of water if he requests it
- 210. Tell him to turn over to give him a shot

UNLESS OTHERWISE DIRECTED CONTINUE WITH THIS SECTION

As you identify the patienthe seems to be squinting at you and membling that his head is hurting. You would be ESPECIALLY interested to check if Mr. Collier has (Select NO MORE than FOUR)

- 211. Cold, clammy skin
- 212. Flushed, warm skin
- 213. Fruity odor to his breath

CONTINUE SECTION ON NEXT PAGE

## SECTION G CONTINUED

- 214. Gasping respirations
  - 215. 'Stuperous behaviour
  - 216. Eaten his breakfast already
  - 217. Eaten his late night snack
  - 218. Restless behaviour
- 

## SECTION H MANAGEMENT

Under these circumstances you would NOW (Choose ONLY ONE)

- 219. Call the head nurse on the intercom
- 220. Give the Insulin immediately.
- 221. Help Mr. Collier to swallow 8 ounces of orange juice mixed with 2 tablespoons of sugar.
- 222. Encourage him to drink 4 ounces of orange juice

UNLESS OTHERWISE DIRECTED YOU WOULD NOW (Choose NO MORE than TWO)

- 223. Give the Insulin immediately
- 224. Call the head nurse on the intercom if you have not already done so
- 225. Encourage Mr. Collier to drink another glass of orange juice
- 226. Give him some crackers to eat
- 227. Get some hard candy for him to eat

UNLESS OTHERWISE DIRECTED CONTINUE WITH SECTION I

---

## SECTION I Management

In giving Mr. Collier his Insulin you would (Select as many as you think pertinent to this situation)

- 228. Check which site he received his last Insulin injection
- 229. Rub the area firmly with an alcohol sponge before and after the injection
- 230. Wipe the skin in a circular motion with an alcohol sponge before injecting
- 231. Inject the Insulin at a 45 degree angle into the subcutaneous tissue of the right upper arm
- 232. Inject the Insulin at a 90 degree angle into the subcutaneous space of the right thigh
- 233. Aspirate for blood
- 234. Apply pressure at the injection site with an alcohol sponge after the injection
- 235. Chart medication as given

UNLESS OTHERWISE DIRECTED CONTINUE WITH SECTION J

---

#### SECTION J Data Gathering

It is now 7.50 a.m. and Mr. Collier's breakfast tray has arrived on the unit. You would NOW (Choose ONLY ONE)

- 236. Delay giving it to him until his doctor arrives at the unit
- 237. Allow him to eat his breakfast because he said he was extremely
- 238. Check the calorie content of the food  
At this time you would (Choose ONLY ONE)
- 239. Remove the piece of toast and package of honey
- 240. Take off the eight ounces of milk and the piece of toast from his tray
- 241. Encourage him to eat all the food on his tray
- 242. Tell the head nurse what has happened and seek her advice what to do next



## SECTION K MANAGEMENT

According to the information you have received you would NOW  
(Choose 243 OR 244.)

- 243. Wait until you are not so busy to chart Mr. Collier's condition on his record
- 244. Obtain Mr. Collier's record and chart immediately.

## SECTION L DATA GATHERING

You return to see how Mr. Collier responded to your treatment. When you enter his room to hear Mr. Collier mumbling to himself that his head is hurting. You would be ESPECIALLY interested to check if Mr. Collier has (Select NO MORE than FOUR)

- 245. Cold, clammy skin
- 246. Flushed, warm skin
- 247. Gasping respirations
- 248. Stuporous behaviour
- 249. Restless behaviour
- 250. Extreme thirst
- 251. Extreme hunger

In view of this information your FIRST action would be to  
(Choose ONLY ONE)

- 252. Call the head nurse on the intercom
- 253. Put a call in for his doctor
- 254. Take his temperature
- 255. Take his blood pressure
- 256. Set up intravenous equipment

UNLESS OTHERWISE DIRECTED CONTINUE WITH SECTION N

\_\_\_\_\_

SECTION M Management

In drawing up the Insulin you have selected into your chosen syringe you would NOW (Answer response 257 OR 258)

257. Prepare the insulin as selected

258. Use the syringe as selected

UNLESS OTHERWISE DIRECTED CONTINUE WITH SECTION

\_\_\_\_\_

## APPENDIX C

## JUDGE'S RATING OF SIMULATION SITUATIONS

TABLE I

## OPTIONS FOR PART I

ITEM NUMBER	RATER					FINAL RATING		ITEM NUMBER	RATER					FINAL RATING
	A	B	C	D	E				A	B	C	D	E	
1	2 <sup>+</sup>	2	2	2	2	2.0		176 <sup>++</sup>	2	2	2	2	2	2.0
2	2	0	1	1	1	1.0		177	-2	-2	-2	-2	-2	-2.0
3	-1	-1	0	0	0	0.0		178	-2	-2	-2	-2	-2	-2.0
4	-2	-2	-2	-2	-2	-2.0		179	-2	-2	-2	-2	-2	-2.0
5	-2	-2	-1	-1	-1	-1.0		180	-2	-2	-2	-2	-2	-2.0
6	1	1	1	1	0	1.0		181	2	2	2	2	2	2.0
7	2	2	1	1	1	1.0		182	-2	-2	-2	-2	-2	-2.0
8	-2	-2	-2	-2	-2	-2.0		183	-2	-2	-2	-2	-2	-2.0
9	2	2	2	2	2	2.0		184	-2	-2	-2	-2	-2	-2.0
10	1	1	0	0	1	1.0		185	2	2	2	2	2	2.0
11	-2	-2	-1	-2	-2	-2.0		186	2	2	2	2	2	2.0
12	2	1	2	1	2	2.0		187	2	2	2	2	2	2.0
13	-1	-1	-1	-1	-2	-1.0		188	0	0	-1	1	0	0.0
14	2	2	2	2	2	2.0		189	-1	-1	-1	-1	0	-1.0
15	-1	-1	-1	-1	-1	1.0		190	-1	-1	-1	-1	-1	-1.0
16	2	2	2	2	2	2.0		191	1	1	2	1	0	1.0
17	2	2	2	2	2	2.0		192	2	2	2	2	2	2.0
18	2	2	2	2	2	2.0		193	2	2	2	2	2	2.0
19	2	2	2	2	2	2.0		194	-1	-2	-2	-2	-2	-2.0
20	2	2	2	2	2	2.0		195	2	2	2	2	2	2.0
21	2	2	2	2	2	2.0		196	2	2	2	2	2	2.0
22	2	2	2	2	2	2.0		197	-2	-2	-2	-2	-2	-2.0
23	2	1	1	1	0	1.0		198	2	2	2	2	2	2.0
24	1	1	1	1	1	1.0		199	-2	-2	-2	-2	-2	-2.0
25	0	0	0	0	0	0.0		200	2	2	1	1	1	1.0
26	0	0	0	0	0	0.0		201	-1	-1	-1	-1	-2	-1.0
27	0	1	1	1	1	1.0		202	2	2	2	2	2	2.0
28	0	1	1	1	1	1.0		203	1	1	0	-1	1	1.0
29	-1	-1	-1	-1	-1	-1.0		204	2	2	2	2	0	2.0
30	1	1	1	0	0	1.0		205	0	0	0	1	2	0.0

- <sup>+</sup>  
 2 = Important  
 1 = Helpful but not so important  
 0 = Optional  
 -1 = Useless but harmless  
 -2 = Harmful

<sup>++</sup>  
 Numbers 31 through 175 have similar ratings to 17 through 30. The section deals with checking medication cards against the Kardex.

TABLE I continued

## OPTIONS FOR PART I

ITEM NUMBER	RATER					FINAL RATING	ITEM NUMBER	RATER					FINAL RATING
	A	B	C	D	E			A	B	C	D	E	
206	2	2	2	2	2	2.0	232	2	2	2	2	2	2.0
207	2	2	2	2	2	2.0	233	2	2	2	2	2	2.0
208	2	1	1	1	0	1.0	234	2	2	2	2	1	2.0
209	-1	-1	-1	-1	0	-1.0	235	2	2	2	2	2	2.0
210	-1	-1	-1	-1	0	-1.0	236	0	0	0	0	0	0.0
211	2	2	2	2	2	2.0	237	1	1	1	1	1	1.0
212	-2	-2	0	-2	-2	-2.0	238	1	1	1	1	0	1.0
213	-2	-2	0	-2	-2	-2.0	239	2	2	1	2	1	2.0
214	-2	-2	0	-2	-2	-2.0	240	-2	-1	-1	-1	-1	-1.0
215	-2	-2	0	-2	-2	-2.0	241	-2	-1	-1	-1	-1	-1.0
216	1	1	1	1	2	1.0	242	2	2	2	2	2	2.0
217	2	2	2	2	2	2.0	243	-2	-2	-2	-2	-2	-2.0
218	2	2	2	2	2	2.0	244	2	2	2	2	2	2.0
219	2	2	2	2	2	2.0	245	-1	-1	-1	-1	-1	-1.0
220	-2	-2	-2	-2	-2	-2.0	246	2	2	2	2	2	2.0
221	2	1	1	1	2	1.0	247	2	2	2	2	2	2.0
222	2	2	2	2	2	2.0	248	2	2	2	2	2	2.0
223	-2	-2	-2	-2	-2	-2.0	249	-1	-1	-1	-1	2	-1.0
224	2	2	2	2	2	2.0	250	2	2	2	2	2	2.0
225	1	1	2	2	1	1.0	251	2	2	2	2	2	2.0
226	2	2	2	2	1	2.0	252	2	2	2	2	2	2.0
227	1	1	2	2	1	1.0	253	2	2	2	2	2	2.0
228	2	2	2	2	2	2.0	254	0	0	-1	-1	-1	-1.0
229	-2	-2	-2	-2	-2	-2.0	255	0	0	-1	-1	-1	-1.0
230	2	2	2	2	2	2.0	256	2	2	2	2	2	2.0
231	1	1	1	1	1	1.0	257	-2	-2	-2	-2	-2	-2.0
							258	-2	-2	-2	-2	-2	-2.0

## APPENDIX D

NAME \_\_\_\_\_

WEEK \_\_\_\_\_

DAILY STUDY TIME

Please record the number of minutes that you spent in study.

a = by yourself; b = with classmates; c = with an RN; d = other (explain).

TIME	0 min	10"	20"	30"	40"	1hr	80"	90"	2hrs	140"	150"	160"	3hrs	TOTAL
MON a														
b														
c														
d														
TUES a														
b														
c														
d														
WED a														
b														
c														
d														
THURS a														
b														
c														
d														
FRI a														
b														
c														
d														
SAT a														
b														
c														
d														
SUN a														
b														
c														
d														

TOTAL AMOUNT OF TIME \_\_\_\_\_

## APPROVAL SHEET

The dissertation submitted by Faith M. Jones has been read and approved by the following Committee:

Dr. Ernest I. Proulx, Chairman  
Professor, Curriculum and Instruction, Loyola

Dr. Barney M. Berlin  
Associate Professor, Curriculum and Instruction,  
Loyola

Dr. Allan C. Ornstein  
Professor, Curriculum and Instruction, Loyola

Dr. Leona M. Smolinski  
Associate Professor, School of Nursing, Loyola

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

8-8-77  
Date

Ernest I Proulx  
Director's Signature